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THE BERLINER DECISION.

The decision in the Berliner case was not unexpected. For months the opposition telephone companies have been preparing to meet the Berliner patent in infringement suits should the decision of the court sustain the validity of its issue. This has now been done, and the effect of the decision seems to be simply the transfer of the field of battle to other courts.

The Government in its suit was not able to sustain the charges of fraud and collusion it had brought against the Bell Company, based on the great delay in the issuance of the Berliner patent. The present decision was rendered solely upon the merits of this contention. The decision does not really affect the validity of the Berliner patent, nor in any way strengthen the position of the Bell Company in infringement suits. In fact there is much evidence, which could not be used by the Government in its suit, which will be available for purposes of defense in suits for alleged infringement that may be brought against the manufacturers of opposition telephones.

Lawyers familiar with the contentions relied upon by the Government in its suit to annul the Berliner patent have all along agreed in the opinion that from a legal standpoint the patent was regular and that the Supreme Court would so decide. While the courts undoubtedly have the power to annul a patent for fraud, no patent ever granted in the United States has been so annulled, nor has such a suit as this ever been previously brought. The general opinion among lawyers competent to decide is that the American Bell will be unable to sustain the validity of the patent itself in infringement suits. It is understood that a prominent New York banking house with a large capital is buying independent exchanges and securing franchises for others, and that it has thoroughly investigated through able counsel the condition of the telephone patent situation, and is satisfied that opposition companies have little to fear from the Berliner patent.

Whatever may be said of this case and its merits, the success of the American Bell Company's business shows conclusively that that corporation has been more than ordinarily well managed, and that its affairs are in the hands of men of shrewdness and ability. It is to be hoped that, as the result of its present legal victory, the company will not repeat the mistakes that were made by another great electrical corporation, which a few years ago reaped a rather barren victory after much litigation against alleged infringers of its incandescent lamp patent.

Now that the decision has been rendered and the air cleared, the positions of the Bell Company and the opposition telephone manufacturers are seen to be a close parallel to those of the various lamp manufacturers after the decision in regard to the incandescent lamp patents. Is it too much to hope that the Bell Company will profit by the experience of the victorious corporation in the former case, and, instead of enriching lawyers and hampering business by unprofitable and vexatious litigation, come to some reasonable agree-

ment with those who have capital invested in the manufacture of telephones? Surely this course would have the merits of common sense and business expediency.

The new industry which has arisen since the expiration of the Bell patent now represents an investment of a very large amount of capital, and employs many persons in various sections of the country. It would be a backward step in progress if this or subsequent litigation should hamper the business in independent telephony which has grown up within the past few years. It is likely that the various opposition telephone companies will stand together in resisting any legal attack by the Bell Company upon their position. Competition in this business, as in others, cannot fail to result in betterment of the service and in general benefit to the public.

CONCERNING NEWSPAPER SCIENCE.

There are a good many people who read nothing but newspapers. The modern type of metropolitan newspaper deals with all sorts and kinds of subjects from religion to pugilism in a fairly acceptable way, but when it undertakes to present scientific or technical articles to its readers the chances are that it will fall into ridiculous errors of statement calculated to mislead and bewilder the public.

In a recent issue the New York *Herald*, which enjoys an enviable distinction in many respects, attempted to report the trial of the third-rail system on the New York, New Haven & Hartford Railroad. Under a five-line "scare-head" the following statements were made: "Put briefly, this test means the attainment of a speed of sixty to seventy-five miles per hour by using electricity as a motive power. Financially it means getting one horse-power out of two tons of coal. In a steam engine it takes from seven to eight tons of coal to get one horse-power."

This information is amazing and novel, but it does not exhaust the capabilities of the reporter. With hardly an interval for recovery from the shock of this statement he informs the astonished reader that "after many experiments the New York, New Haven & Hartford electricians discovered that by a heavy rail, that looks like a capital 'A' flattened down, and laid on blocks of wood, the electrical current could be transmitted without any appreciable loss of power, and at one-fifth the cost of a trolley line."

The humor of this sort of thing is tempered with the pity that must be felt for the reader who accepts such statements, authorized by their appearance in a newspaper of high standing, as truthful. It has been pointed out in these columns before that knowledge is cheap nowadays, and that competent supervision of these so-called scientific articles can be had at an almost nominal rate. It certainly does not pay for a newspaper to make palpable and glaring errors of statement.

AN EXPERIMENT IN ELECTRIC TRACTION.

The recent test of the third-rail system on the tracks of the New England & New York, New Haven & Hartford Railroads between New Britain and Hartford, while exhibiting no new features and demonstrating nothing of electrical importance, yet possesses the greatest interest as the first serious attempt at the operation of trunk-line railroads by electricity, and may be regarded as an epoch-marking event in the history of electric traction.

The importance of the event in another way is no less great, for it shows conclusively that the management of this great system of steam railways is awake to the importance of an early start in electric traction, and considers electricity a feasible and satisfactory agent for operating interurban trains on short runs. The experiment is really only a continuation of that begun at Nantasket Beach by the same railroad company, but upon a larger scale and under more practical conditions.

While the methods used are simple and apparently well adapted to the requirements of the situation, they are not adapted to be extended over any large part of the railway system. The voltage used must be necessarily kept low on a third-rail system liable to accidental contact from workmen and trespassers, and this fact alone shortens the radius of successful operation from a single power house. The difficulty of making "flying switches" is also apparent.

The return, in this installation, to the methods used by Mr. Leo Daft eleven years ago is noteworthy. There is not much difference, except in size, between the third-rail system installed at Baltimore in 1886 and that just completed in Connecticut. The generators and motors used are, of course, vastly better and more efficient in the latter case. There seems no reason why the system experimentally inaugurated at Berlin should not be extended from Hartford to New Haven and to the numerous small towns in central Connecticut, thus serving a densely-populated neighborhood in which interurban travel would be very great.

THE ELECTRIC MOTOR CARRIAGE.

With electric cabs in service in the streets of New York and electric carriages making their appearance on all sides, it seems that the long-awaited era of mechanical locomotion on roads and highways has arrived. Enthusiasts are already predicting the relegation of the horse to the museums of zoology, where, in future days, he will be exhibited as a curiosity to a race of motor-using humans.

In all seriousness the advent of the electric automobile vehicle is an important matter, deserving consideration for the effects it is likely to produce in many directions. Probably the most noticeable immediate consequences due to its appearance will be a decrease of noise and filth in city streets and a general demand for improved highway roads.

Prophecy is not lightly to be undertaken, but the displacement of the horse by the motor on street railways furnishes a tempting parallel. The future of this new means of transit is certainly very great, but it is a difficult if not impossible matter to say in which of the numerous possible avenues of development the automobile vehicle will make its greatest advance.

The difficulties which builders of electric vehicles have encountered heretofore were almost always with the accumulators. Their great weight and rapid deterioration, combined with the difficulties of charging them, all operated against the success of the new vehicles. It is to be hoped that these troubles have been as successfully overcome in the motor carriage described on another page as have been the mechanical troubles which have beset many former experimenters.

As a rule the demand for any new article of manufacture compels its appearance in the market sooner or later. The success of electric automobiles will unquestionably cause a desire on the part of their users for a longer radius of travel, which only means an accumulator of greater capacity for a given size and weight. This is almost certain to be produced when the demand for it is sufficiently urgent.

The Berliner Case Decided in Bell's Favor.

The suit of the United States against the American Bell Telephone Company, brought to annul the Berliner patent of 1891, was decided on May 10 in favor of the Bell Company. Mr. Justice Brewer delivered the opinion, Justice Harlan dissenting, and Justices Gray and Brown, who had not heard the arguments, taking no part in the case.

The court, in its opinion, held that there was no evidence of corruption or undue influence exercised over the Patent Office by the Bell Company, and that there was no evidence that the delay in granting the patent had been brought about by the company. It held that whatever delay there had been was through the fault of the Patent Office and by no fault of the company.

The court held that in order to set aside a patent the Government must establish grounds of relief as clear and satisfactory as it would to set aside a land patent. All other allegations of the Government besides that of delay were overruled.

This case has attracted wide attention because of the extensive interests involved in its settlement, and the opinion of the court has been anxiously awaited. The suit, it was claimed, involved the practical control of the art of telephoning. It originated in a charge of collusion in the Patent Office and was brought to obtain the repeal and cancellation of letters patent of the United States 463,569, dated November 17, 1891, granted to the American Bell Telephone Company, as assignee of Emile Berliner, the alleged inventor. The repeal and cancellation of the patent were sought upon the ground that the application for it, while filed in 1877, was not issued until 1891. This delay was charged to be unnecessary and improper on the part of the Patent Office and the Bell Telephone Company, which, as Berliner's assignee, controlled the application. It was asserted that the company had acquiesced in and promoted the delay for their own interest, thus defrauding the public of its rights.

It was claimed that the Berliner patent practically controls telephony, as it has to do with both the transmission and receipt of sound, and that the delay thus secured until 1891 operated to prolong the control for fifteen years beyond the time of the expiration of the Bell patent.

It was also asserted that the patent was granted by the Commissioner of Patents without authority of law, and that it was for the same invention for which a patent had been granted in 1880, and that the principle was therefore not new.

It is not likely that the full text of the opinion of the court will be given out for publication for some days yet. Mr. Justice Brewer read merely a synopsis of the principal points in the opinion when the decision was rendered.

At the outset Justice Brewer said that this was the first case in this court in which an application has been presented to set aside a patent for an invention, wrongfully issued. However, there was no doubt of the right of the United States to maintain such a suit. The question, therefore, to be decided was whether upon facts disclosed the relief ought to be awarded. He took up the difference between patents for invention and land patents, the principal difference, he said, being that invention patents do not cover something which belonged to the Government before it was invented. Hence, in this case, the patent conveyed to Berliner nothing that he did not before have. The patent only gave him exclusive rights for a time as an inducement to make it public. Consequently the Government has higher rights in a suit to set aside a patent for land than in a similar suit on a patent for an invention.

Taking up the question of delay in the Patent Office, Justice Brewer said the application was pending in the department for fourteen years, during thirteen of which the invention was the property of the Bell Telephone Company. Mr. Bell has invented the telephone, and as that patent had expired all the monopoly which attaches to it alone has ceased and the right to use it has become public property. But his apparatus was insufficient for public uses. Berliner's patent supplied the deficiency of existing patents, as he invented something by which, taken in connection with Edison's and Blake's inventions, Bell's undulating current could be made practically available for carrying on conversations at long distances. In other words, the telephone used to-day is not only that of Bell, but of Edison, Blake, and Berliner as well. Therefore the right to use the Bell patent alone would be a barren one, extending the telephone patent to life of the Berliner patent.

He said that some delay was unavoidable in the Patent Office. An application for patent cannot be considered and determined on the instant. Hence there could be no complaint on the mere fact of delay, though there might be of its excessiveness. But, added the opinion, it mattered not whether the delay be reasonable or unreasonable, if the applicant is not responsible for it. If the fault was that of the Patent Office the applicant is not held blameworthy, and his legal rights are not affected. He cannot be punished on account of the delay or negligence of the tribunal before which he is presenting his suit.

With reference to the arguments on the subject of the continuance of the telephone monopoly, Justice Brewer repeated that there was no question that Bell's patent had expired, but it must be remembered that Berliner's rights were independent of those of Bell. If there should be a new invention upon the expiration of the Berliner patent the rights of its author could not be abridged to relieve the public. The inventor of the latest addition is entitled to full protection, and if the telephone company buys that invention it is entitled to all the rights which the inventor had. The court, he says, dissented entirely from the views urged by counsel, that the applicant for a patent was a quasi trustee for the public, but held that an invention was the absolute property of its inventor. The Government in order to make its case must establish affirmatively that the delay in the Patent Office was caused by the conduct of the applicant. It cannot rest on mere inferences, but must prove the wrong in such a manner as to satisfy the judgment before it can destroy that which its own agents have created. This requirement the Government had failed to meet.

Continuing on this point, he said there was no testimony as to any corruption of the officers of the department by the defendants, or any attempt at such corruption. So far, indeed, as was shown, there never was an intimation made to a single official that he could profit by a moment's delay. All thought of wrong, therefore, may be put aside. Counsel for the Government had tried to show that the fact that the applicants were not active in their prosecution was an evidence of fraud in view of the vast value of the invention, but this argument did not counteract the fact that there was no request for delay, but, on the contrary, the applicants had made at least one urgent request for action. Something more than the mere assertion of counsel was necessary to meet this fact. He considered at some length the charge of existence of a tacit understanding between the officials of the Patent Office, the People's Telephone Company, and the Bell Company that the Patent Office proceedings in the Berliner application should await determination of the litigation between the two telephone companies, involving the validity of the Drawbaugh patent, owned by the People's Company, but even if this was so, it did not anywhere appear that Berliner was a party to such an understanding. The difficulty was that the assertion was not proved. Indeed, Justice Brewer asserted that a case is seldom presented in which there is such a total failure of proof of wrong.

He said further that the testimony showed that the examiners in the Patent Office had acted in good faith, whatever is to be said of the wisdom of the course pursued by them. They supposed they were acting in compliance with the rules of the office, and out of proper regard for conflicting interests. It was not strange, when there was so much litigation, controversy, and uncertainty, that there should be delay in settling a minor matter in the Patent Office until there should be a final decision of the primary right. It was easy to say that there should have been prompter action, but a wisdom born after the event is the cheapest of all wisdom.

The conclusions of the court, very much condensed, on this branch of the case were:

First—That before the Government is entitled to a decree cancelling a mechanical patent, on the ground that it has been fraudulently obtained, it must establish the fraud by convincing testimony.

Second—That an applicant for a patent cannot be held responsible for the dilatory acts of Patent Office officials, unless the delay is brought about through his corruption.

Third—The evidence in this case does not tend in the least degree to show any such corruption.

Fourth—If the circumstances do not show that the delay on the part of the officials was wholly justified, they do make it clear that it was not wholly unwarranted.

Of the contention that "a patent issued November 2, 1880, upon a division of the original application, covers the same invention as that covered by the patent in suit, and exhausted the power of the Commissioner as to that invention," he said the patent of 1880 was for a receiver, while that of 1891 was for a transmitter. It was claimed that the two inventions were one, but the decision of the Patent Office was against this contention, and this judgment could not be reviewed in the present suit.

Remarking upon another feature of the case, the Justice said that, taking into consideration the influences under which the suit was started, there were indications that the purpose of striking down this patent was to give value to others, and that private competitors of the Bell Company are seeking to injure a rival, not for the public good, but for the promotion of their personal interests.

He said that Congress had established the Patent Office, and had thereby created a tribunal to pass upon all questions of novelty and utility, and had given to that office exclusive jurisdiction in the first instance, with specifications of circumstances under which they might be reviewed.

It would seem that the Government should be as firmly bound by the decision of its own tribunal as individuals. There was nothing inconsistent, he said, between this view and that propounded in the case of the United States versus the Bell Telephone Company. There might, he concluded, have been an error on the part of the officials as to the existence of power or a mistake in the instrument itself, sufficient to justify a decree cancelling the patent. Also, the deviation of the proceedings between the application and the patent may be such as to justify the interposition of the court of equity, but it was not intended that the courts of the United States, sitting as courts of equity, could entertain jurisdiction of a suit by the United States to set aside a patent for an invention, on the ground of error of judgment on the part of the patent officials. Hence this question was not now open for consideration.

Mr. Justice Harlan, who dissented, delivered no opinion.

The History of the Berliner Patent.

The history of the 1891 Berliner telephone patent begins with the filing of a caveat by Emil Berliner on April 14, 1877, describing the variable pressure constant contact transmitter. On April 24 of the same year T. A. Edison made application for a patent in which an electrode presenting a considerable surface coated with plumbago is in contact with the diaphragm, but did not make any claim for the principle of variable pressure and constant contact that was involved in its operation. His patent, number 474,230, issued in 1892, is based upon this application. On June 4, 1877, Berliner filed his application for a patent on the invention described by the caveat of April, which patent was finally granted in 1891. On July 20, 1877, Edison filed an application covering broadly the use of carbon for the electrode contact in variable pressure and constant contact transmitters. This resulted in patent number 474,231 of 1892. In March, 1878, interference proceedings relating to the Berliner patent were begun and ended in 1882. In that year Drawbaugh's claims and suits were filed, resulting in the withholding of the patent on their account until 1888. The Patent Office in that year rejected the application of Berliner on the ground that his original application was improper, and because of intermediate patents; but in 1889 reversed this decision. For two years afterward proceedings in connection with the Drawbaugh claims occupied the Patent Office, and the patent had to await the final decision of the Supreme Court in the Drawbaugh case, being finally issued November 17, 1891.

During the thirteen years in which the Berliner application involving the fundamental principle of the microphone was thus in litigation, the inventor applied for and obtained a number of patents on telephones, the first of which was issued June 15, 1878, on application dated October 16, 1877. This patent is for a receiving instrument consisting of several metal or carbon electrodes in contact with the metal or carbon diaphragm, or of two diaphragms, each having a single electrode in contact. (Fig. 1.) It also includes a telephonic relay consisting of two iron cores, one coil of each forming a closed circuit, and the other coil of each being in the transmitting and receiving circuit, respectively, each of these circuits containing a primary battery. It is claimed in the specifications that by this means the transmitting current in the coil will affect the current in the receiving current, so as to increase its action on the receiving instrument.

The second Berliner patent (No. 222,652) was granted December 16, 1879, on an application filed August 11 of the same year, and

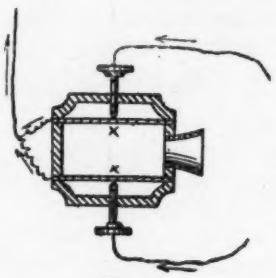


Fig. 1.

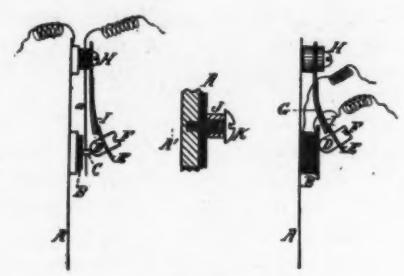


Fig. 4.

related to a carbon telephone and a method of preparing and hardening the carbon electrode. The claims referring to this instrument, which is shown by Fig. 2, relate to the electrode, which may rest by its weight on the diaphragm or be clamped in position, and also includes a process of manufacture of the carbon electrode.

The next Berliner patent, No. 224,573, dated February 17, 1880, is on methods of dispensing with the clamping device for the carbon electrode referred to, maintaining the electrode constantly in contact with the diaphragm by the action of gravity, and in connecting the electrode to the battery by a device that will not interfere with its action. The illustrations accompanying the specifications are reproduced in Fig. 3.

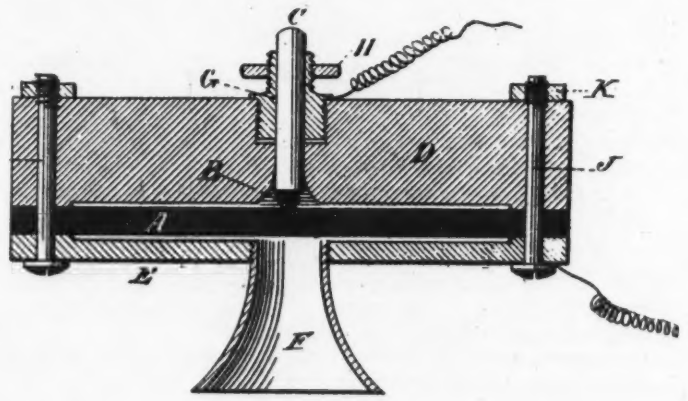


Fig. 2.

Patent No. 225,790, dated March 23, 1880, is on methods of keeping the carbon electrode in contact with the diaphragm by means of a pendulous weight suspended by a band or ribbon or some flexible material, as shown in Fig. 4.

Patent No. 234,744, dated November 23, 1880, covers various details relating to the device described in No. 225,790. The four patents, Nos. 222,652, 224,575, 225,790, and 234,744 were combined in one patent granted in England, France and Belgium. Patent dated May 24, 1881, No. 241,912, has an improvement relating to that class of telephones in which one electrode is held in position by being attached to a spring.

Patent No. 248,839, dated November 1, 1881, contains claims on electrodes in an air-tight box in which there is a vacuum, and also on certain particular arrangements of the carbon electrodes.

The patent granted November 2, 1880, No. 233,969, is the famous patent which had such bearing in the recently decided case. Its importance comes from the construction placed by the Government counsel in the Berliner suits on the final claim. This claim reads as follows:

"A system of two or more telephone instruments in electrical

connection with each other, each consisting of two or more poles on an electrical circuit in contact with one another, either or both poles of each instrument being connected with a vibratory plate, so that any vibration which is made at one contact is reproduced at the other, substantially as set forth."

Fig. 5 is a reproduction of the drawing of the patent of November 2, 1880, which is identical with that of the patent of 1891. The

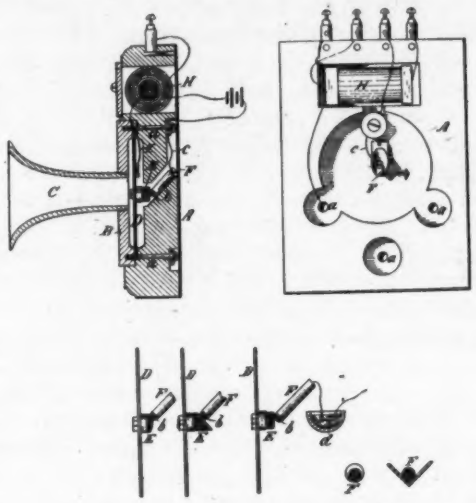


FIG. 3.

following are the claims of the latter patent upon which its great value depends:

"1. The method of producing in a circuit electrical undulations similar in form to sound waves by causing the sound waves to vary the pressure between electrodes in constant contact, so as to strengthen and weaken the contact, and thereby increase and diminish the resistance of the circuit substantially as described.

"2. An electric speaking telephone transmitter operated by sound waves, electrodes in constant contact with each other, and forming part of a circuit, which includes a battery or other source of electric energy, and adapted to increase and decrease the resist-

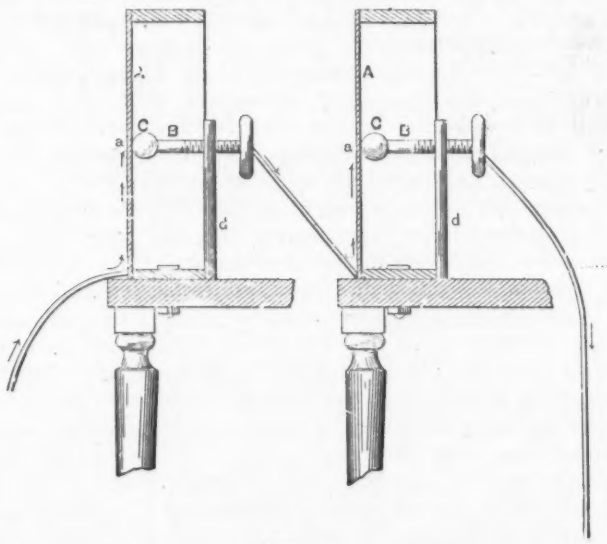


FIG. 5.

ance of the electric circuit by the variation in pressure between them caused by the vibrational movement of said sensitive plate.

"3. The combination, with the diaphragm and vibratory electrode, of a rigidly-held opposing electrode in constant contact with the vibratory electrode, substantially as described.

"6. A speaking telephone transmitter comprising a diaphragm or disc sensitive to sound waves, combined with the rigidly-held but adjustable electrode in contact with the same, whereby the electric current is transformed into a series of undulations corresponding with the vibrations of said diaphragm."

In the United States Circuit Court for the District of Massachusetts, Judge Carpenter held that the 1880 patent was for a system or combination of a transmitter and receiver for a speaking telephone.

"The whole apparatus is shown in the drawings of both patents and is identically the same in both. The transmitter and the receiver are identical in form and differ in function according as they are placed at the transmitting or at the receiving end of the telephone wire. It, therefore, appears that one of the functions of the device shown in the patent of 1880, namely, the function of transmitting articulate speech, is identical with the sole object or function of the device covered by the patent of 1891, and that the device for effecting the transmission is identical in both patents. The patent, therefore, seems to me to be void and beyond the power of a commissioner to issue."

The suit before Judge Carpenter, as is well known, was brought by the United States versus the American Bell Telephone Company to set aside the patent on the ground of fraudulent issue, and was decided in favor of the United States. After appeal to the Circuit Court of Appeals this decision was reversed, and the contention of the Berliner claimants upheld. From this opinion the United States appealed to the Supreme Court, with the result that the Circuit Court was sustained and the suit decided in favor of the American Bell Telephone Company.

The Effect of the Berliner Decision.

Independent telephone manufacturers do not seem to worry much over the Berliner case. The decision was generally expected, and the consensus of opinion seems to be that its chief effect will be to delay the settlement of the telephone question a little longer, but that the final result will be the free use of the telephone. It is generally thought that telephone manufacturers will combine to resist any legal attack by the American Bell Telephone Company for alleged infringement of the Berliner patent, and, since there is a large investment in opposition telephone exchanges and in the manufacture of telephones, a determined effort will be made to prove the Berliner patent invalid. It is perfectly possible for manufacturers of opposition telephones to work under the Blake transmitter patent, which has now expired.

THE ELECTRICAL WORLD has endeavored to obtain from the officers of the American Bell Telephone Company some idea of the policy which that company would pursue now that this important decision has been rendered in its favor. While the officers were naturally pleased over the decision, they would say nothing for publication as to what they would do in the future, except that the public might expect a very high class of telephone service. They would not discuss the question whether the company contemplated engaging in the telegraph business, but what they said might be construed as indicating that there was at present no such intention. It is known, however, that the Bell Company keeps very closely informed on everything that occurs in the telegraph field.

Mr. F. P. Fish, counsel of the American Bell Company, was of course highly gratified over the decision. In an interview with him, he said that he had not yet seen the opinion of the court, and was, therefore, unable to discuss the matter at as great length as he would had he known just how certain points had been treated in the opinion. He said the decision disposed of the charges of fraud in connection with the use of the patent which had been brought against the Bell Company, and that the only question now to be determined was as to whether the second patent was invalid by reason of its covering the same invention that was embodied in the earlier patent. The American Bell has two suits for infringements pending, one against the National Telephone Company and the other against the Century Telephone Company, both of Boston. Mr. Fish said that these suits would be pushed to completion as rapidly as possible, and he hoped that a decision would be reached in one of them by next Spring, and perhaps sooner. "The American Bell," he continued, "is anxious to have a decision at the earliest moment, as it prefers to know whether it is working under a patent that is valid or invalid."

Mr. Causten Brown, counsel of the Government in the Berliner case, was not willing to discuss the decision until he had examined the opinion of the court. He stated, however, that there were a number of defenses which would be available in case of a suit for infringement of the Berliner patent, which were not available to the Government in the present case.

Mr. Jas. McNaught, of McNaught & Redding, lawyers, New York, said: "The court did not pass upon any of the questions presented except the one of fraud. The court held that the Gov-

ernment had not shown sufficient fraud to warrant the cancelling of the patent. As to the other points, Justice Brewer, in delivering the opinion of the court, said: 'The other points set up by the Government were equally open to any person aggrieved by the issue of the patent, but were not sufficient to justify the court in cancelling the patent in this proceeding.' The questions as to the validity, priority and scope of the Berliner patent, by this decision are left open, and can only be settled in infringement suits between private parties. The independent telephone companies claim that Edison, and not Berliner, was the first discoverer of the constant contact variable pressure microphone. Edison made his discovery January 7, 1877; Berliner March 14, 1877. It is also claimed that, under the decision in the Bate refrigerator case, Berliner's American patent expired with his foreign patents. Many patent lawyers also claim that Berliner did not invent or discover anything; that he applied Bell's method of transmitting speech by undulatory currents to Reis' old apparatus; that he adjusted the electrodes; that this involves mechanical skill only and not invention.

"Berliner took out his patents in foreign countries for 'improvements' on the microphone, thus attempting to avoid the question finally decided by the Supreme Court of the United States in the Bate Refrigerator case. He failed palpably in one instance, however. In one foreign country Berliner and Edison took out patents covering the variable pressure constant contact microphone, and their patents both expired before Berliner's transmitter patent of 1891 was issued.

"The foregoing are but a few of the many defenses open to the independent telephone company in an infringement suit. Independent telephone companies, therefore, will pay no attention whatever to this decision."

The opinions of the various manufacturers of opposition telephones seem to be unanimous that the effect of the decision will not materially change the telephone situation.

The Missouri Telephone Manufacturing Company, of St. Louis, telegraphs as follows: "The big Kinloch Telephone Company here has asked the City Council for the extension of its conduit territory. The Berliner decision does not frighten any one who understands the issue."

The Standard Telephone & Electric Company, Madison, Wis., telegraphs to The Electrical World: "The Berliner patent decision simply acquits the Bell Company of fraud and collusion in the issue of the patent. The patent will never be sustained on its merits, and we are anxious to at once try conclusions with the Bell Company in a suit for infringement, either against us or the users of our telephone."

Messrs. Taber & Mayer, of Boston, Mass., say: "We have not been able to form a decided opinion on the Berliner decision, not having seen the full text of the opinion. It is our opinion, however, that this will not seriously affect the telephone interests, as it can only delay a settlement for a while longer. We think the ultimate outcome will be the free use of the telephone."

Mr. James E. Keelyn, president of the Western Telephone Construction Company, Chicago, writes:

"The Berliner patent decision by the Supreme Court is but cold comfort for the Bell monopoly, although it is probably more than they had expected to gain through this farcical patent up to the time of its issue. The Bell people will undoubtedly make the same use of it that they make of other worthless patents. Intimidation, scarecrow literature and misrepresentation will now be the order until a change comes.

"The Supreme Court's opinion was on but one insignificant point, and upon a point that probably no one but a Government official would have been fool enough to have used to overcome the evil of this patent. The whole Government suit was a travesty upon our judicial procedure. If the Bell Company had outlined a plan to secure to them the greatest benefit from the fraudulent Berliner patent, it could hardly have done so better than the Government officials have done it for them. The policy of the Bell Company to frighten the public upon patent questions will therefore be continued a short time longer.

"The Western Telephone Construction Company has had no fears because of the Berliner patent. For a long time it has had in its possession absolute evidence, properly certified to, and ready to be used in defense of a motion upon a preliminary injunction, if brought, which evidence, without question, would prevent an interference with its product.

"This is tantamount to saying that upon a proper presentation of facts, data for which are in our possession, the Berliner patent is worthless at law.

"It is intimated that the Bell people will not sue this company nor its customers upon this patent at first, but will file a great many suits against weaker institutions. This is to be regretted, if true; although a narrow-minded policy might assume it to be to our advantage. Our well-known endeavor to clear the telephone situation from patent difficulties of a blackmailing or bulldozing sort leads us to desire the Berliner scarecrow buried with the Watson and the Roosevelt patents.

"We have been again approached by other concerns in this business, asking that we combine, and in associated form fight this patent. We have refused to enter into any more combinations, and will confine our efforts to defending our own product, our customers and ourselves in patent litigation. The evidence we have is so clear that no precedent can be established to our injury.

"We imagine, therefore, that temporarily the effect of the Berliner patent will be like a wet blanket over some people in the independent telephone business. However, the independent telephone movement will move on with renewed strength and greater vigor. Ninety days hence this cloud will have rolled away to some extent; stronger and better conditions will prevail. The Bell Company will have been proved to be weaker, and the success of the independent telephone exchanges more fully assured.

"We are giving ourselves only that amount of concern which any good business institution would have in a matter of this kind. It does not interfere with the character of our product one iota. We have long since discounted any evil effects."

Prof. A. E. Dolbear, of Tufts College, Medford, Mass., said that he had nothing special to say regarding the decision. He was, however, very much surprised at the result. He did not see how a decision could be rendered in such a way. There were certainly no ethical grounds, and it could be given in favor of the American Bell Company only on legal technicalities. Regarding the course to be taken by the opposition, he believed that by taking the stand that the same patents had expired in other countries a verdict would be rendered in its favor similar to that given in the Bates refrigerator case. As to the final outcome, it was impossible to predict what would happen.

Mr. F. A. Ross, general manager of the Stromberg-Carlson Telephone Manufacturing Company, Chicago, writes:

"For our part we are jubilant over this decision, and we consider it a signal victory for the opposition companies for the following reasons, which certainly appeal to common sense, viz.,

"The Supreme Court refused to consider the question of validity of the patent in view of the 1880 Berliner patent and other defenses, thus compelling the Bell Company to settle the vital questions relating to anticipation by a protracted infringement suit, which cannot be settled for many years. Judge Carpenter, of Boston, who passed upon the questions which will arise in the infringement suit decided against the Bell Company, and it is reasonable to suppose that any other court will do the same thing.

"The Appellate and Supreme Courts hold that these questions which will arise in an infringement suit could not properly be considered in a suit founded on fraud.

"The Chicago Record, in an editorial of May 11, sums up the situation better than we can do it, as follows:

" 'The policy of the Bell Company in evading a decision upon all the grounds of invalidity that had been raised, and thus throwing away an opportunity to gain a clear title to the invention, if it had a right to it, seems to lend color to the claim of the independent telephone companies that the Bell Company has really little faith in this patent, and that, instead of securing a judicial decision upon the merits of the case, it proposes to use the Berliner patent and the decision of the United States Supreme Court as a club over weaker corporations. In spite of all the claims that may be made by the American Bell Telephone Company and its agents and advocates, the decision of the Supreme Court of the United States is apparently of no practical value in continuing and sustaining the monopoly of the telephone industry.'

"As to the moral effect of the decision on public business, there is no question but that it will be more or less great until the public

comes to learn that this is but another cloud the Bell Company has shrewdly thrown over the industry. Nerveless and weak-kneed investors will undoubtedly take alarm for the time being, but this decision gives to those best posted wonderful opportunities to make telephones while the clouds hang low."

Mr. W. L. Bradshaw, general manager of the Simplex Interior Telephone Company, Cincinnati, says:

"In my opinion the earliest and most disastrous results will be the loss of confidence on the part of the general public, brought about by the misinterpretation of the sense of the decision in question. This loss of confidence will, of course, largely affect the sale of telephones by independent companies.

"So far as the American Bell Telephone Company is concerned it is not yet apparent to me wherein they are benefited by this decision, other than by the removal of the stigma of fraudulency. In fact, I rather envy the first concern that may successfully defend a suit for infringement of this patent. That such a suit can and will be successfully defended I have not the slightest doubt."

The Williams-Abbott Electric Company, of Cleveland, writes us:

"In our opinion, this decision is the best thing that could happen to the independent telephone interests, inasmuch as the technical value of the patent has never been brought to test, and now in a short time undoubtedly will be and settled on its merits. As every one acquainted with the history and value of telephone patent knows, the Berliner patent, granted in 1879, and the Bell patent, granted in 1876, are the basic patents that the telephone industry has been founded on, and both of these patents have expired.

"The Berliner patent of 1891 practically covers the same ground as the Berliner patent of 1879, and we do not see how there can be any question as to the Berliner patent of 1891 any longer retarding the progress of the independent telephone companies."

Mr. Raymond L. Whitman, of Whitman & Couch, Boston, writes:

"The recent decision on the Berliner patent most certainly frees the Bell Company from the charge of fraud and collusion with the Patent Office in delaying the issuance of the Berliner patent, so far as a decision arrived at with one judge dissenting and two judges refusing to act, on account of being interested parties, can do so.

"The decision has, nevertheless, made it a fact to all intents and purposes that the patent was obtained as soon as possible, so far as the Bell people were concerned; but the Patent Office must confess to the most inexcusable negligence or exceedingly poor management.

"Since this is a matter of the past we must look to the probable effect of the decision both upon the public and the independent telephone exchanges and manufacturers. First, the decision has done away with but one count, that of fraudulent delay on the part of the Bell Company in collusion with the Patent Office in issuing the Berliner patent. This is all that has been decided; the merits of the patent have not been discussed or passed upon.

"How does this affect the public? The answer is that the public stands in precisely the same condition as it has heretofore, i. e., the validity of the Berliner patent is still to be tested, and the public has the right to use any and all makes of 'phones just as it has for the past few years, until such time as the Berliner patent shall have been proven valid, which time, in my opinion, will never come.

"The public will be threatened and bullied by the Bell monopoly, and no doubt the monopoly will use this decision as a club on those unfamiliar with this case, and undoubtedly extort, as hereto fore, exorbitant rentals from all the timid.

"The public should have no fear, but continue to patronize the independent companies, and thereby aid in freeing themselves from a monopoly which demands such exorbitant rentals, and one which often gives such poor service."

Mr. George W. Sutton, president of the Phoenix Interior Telephone Company, New York, says:

"We regard the decision as a moral victory only for the Bell Company, inasmuch as the court simply acquits it of the charge of obtaining the patent through fraud, and does not pass upon the other and more vital points involved. There is no question but that the patent is invalid, on other grounds than fraud, and will be so declared by the courts, should the Bell Company bring suit for infringement."

Niagara Falls Convention of the American Street Railway Association.

A circular has just been issued by President Robert McCulloch and Secretary T. C. Penington, of the American Street Railway Association, giving some facts regarding the arrangements for the next convention of the association, which will be held at Niagara Falls, N. Y., October 19, 20 21 and 22 next.

The executive committee is making every arrangement for the convenience and accommodation of the supply men who intend to make exhibits and displays on this occasion. A commodious exhibit hall, 120 by 154 feet, is now being erected at Niagara Falls, in close proximity to all the hotels, and arrangements have been made to extend the steam railroad tracks, which approach the building within 200 feet, into the building itself, thus saving exhibitors all charges for cartage. A side track will be laid in front of the hall for cars, sweepers, etc.

The meetings will be held on the second floor of the Exhibition Hall. All the hotels will be kept open, and they have agreed to keep their charges at reasonable figures. The executive committee has fixed a price for exhibition space at 10 cents per square foot, and no space of less than 100 square feet will be assigned, but applicants may have as many multiples of this quantity as they may wish, all in one body. Applications for space should be made to Mr. H. W. Beardsley, chairman of the committee on exhibits, Niagara Falls, N. Y. Space must be applied for by September 1, and assignments will be made as promptly as possible after that date. Possession of the hall can be had on Monday, October 11, and watchmen will be in charge of the premises, so that exhibits will be carefully guarded.

The executive committee found their Niagara Falls and Buffalo brethren very enthusiastic over the coming meeting, and so hospitable in their greetings that a successful meeting is assured.

The annual dinner will be held at the International Hotel, October 21, at 8 P. M. All the railroads will sell tickets on the usual certificate plan.

The Meeting of the American Institute of Electrical Engineers at Elliot, Me.

In connection with the meeting of the American Institute of Electrical Engineers, which will be held at the home of the late Prof. Moses G. Farmer, at Greenacre, Elliot, Me., on July 26 next, it is interesting to note that extraordinary arrangements are being made to accommodate the visitors on that occasion. Professor Farmer's daughter is at the head of a movement for the education and elevation of the people, which has developed into a very large and substantial institution. The work prosecuted by Miss Farmer is in the nature of a summer school, which combines the advantages of rest and recreation of a rational character with rare opportunities for the development of the higher nature. The movement was initiated in 1894, and since that time lectures from well-known representatives of scientific and philosophic thought have been delivered there.

The Greenacre School of Music will hold its meeting at Greenacre in July and August, at which general lectures will be delivered upon many diverse topics. During the last week in July it is Miss Farmers's intention to commemorate the fiftieth anniversary of her father's earliest work in the electrical field, which involves the application of electricity to motor traction. The lectures of the conference during this week will commemorate different phases of progress in electrical science, and there will be an exhibition during the month of July of interesting material, illustrating the earliest attempts at motor traction by means of electricity, and the subsequent evolution of this method of transportation.

It is stated that Miss Farmer has been assured the co-operation of the Patent Office at Washington in obtaining material for the exhibit to be made on this occasion. A few of the early models will be exhibited, and the loan collection will be in the main a graphic one. Any persons possessing models, drawings or other portable material bearing upon the subject of electrical scientific progress, and willing to permit its use in this exhibition, may make suitable arrangements by communicating with Miss Farmer at the earliest possible moment.

The Columbia Electric Motor Carriage.

THE substitution of mechanical for animal energy for the propulsion of wheeled vehicles intended to travel over common roads is probably pre-eminent among the problems of the day. Ever since the earliest ages man has relied on muscle-power for this purpose, and, notwithstanding the development of the various mechanical motive powers and their application to almost every industrial purpose, locomotion over common roads still retains the general principles included in its earliest conceptions. With the introduction of various portable mechanical motive powers, their application to the propulsion of road vehicles has always been one of the earliest suggestions. Previous even to the steam railroad, steam energy was applied to the propulsion of conveyances intended to travel over ordinary roads. Gas and vapor engines were also used during their early development for this purpose, and the appearance of the storage battery used in conjunction with the electric motor seemed to indicate most promising possibilities. Although innumerable motor-propelled road vehicles have been devised and used intermittently, actual serious development has really only taken place within the past ten or fifteen years. The perfection of various light portable motive powers has certainly been a great step in advancing the motor carriage problem.

Motor-propelled road vehicles for business and other purposes, of the type generally known as motor carriages, have for some years past been actively developed on a commercial scale in Europe. General attention has been particularly attracted to them by the various recent races and meets, which seem to have aroused the renewed vigor of the multitude of inventors who place their faith in this substitution of mechanical for animal energy. Many have been the attempts to solve the problem. Steam, gas, electric, compressed air and many other forms of portable motors have been tried with, in some cases, very excellent results.

For some time it has been well known that one of the largest bicycle manufacturers of the world, the Pope Manufacturing Company, has been actively engaged in the solution of the motor propelled road vehicle problem. After two years of investigation and experiment with various forms of motors, including gas, steam and electric, the Columbia electric motor carriage has been evolved, tried and tested in every detail, to the satisfaction of its designers and builders, who on Thursday, May 13, publicly exhibited the perfected carriage. No little satisfaction will be experienced by those who put their faith in the electrical vehicle, now that electrical motive power has been adopted after conservative and unbiased deliberation, and even after experiments had been made with gas and other forms of motive power.

The new carriage takes the form of a modified phaeton, with box body and folding hoood. Mechanical appearance is scarcely in evidence, and the design and finish is equal to the highest standard of such work. The upper body of the carriage is of the box type, with a centrally located double seat, curved dashboard, and comfortably seats two persons. The finish is black carriage enamel. Electric carriage lamps are placed on each side of the seat and also at the centre of the dashboard. Three compound flat springs transversely fastened to the lower frame or truck support the entire upper body, which is not supported at any other point. The separation of the carriage body from the supporting frame, or so-called truck, is an important element in the construction of the vehicle and has peculiar advantages. The entire truck is built of steel bicycle tubing made of 50 per cent. carbon steel, and selected in dimensions that enable it to be used in the annealed state. Tubing is also used for all connecting rods and

The Columbia Electric Motor Carriage.

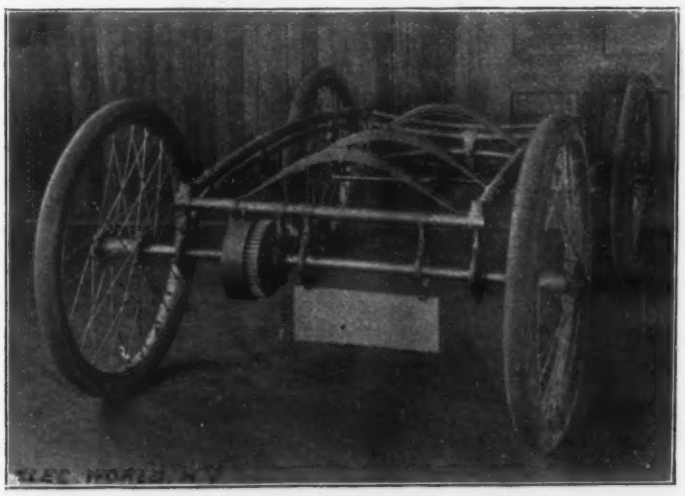
levers wherever possible, but where irregular shapes are necessary, forgings have been adopted. The sides and front of the frame are constructed of double tubing, rigidly braced and brazed at various points, and bent in such shape as to give the maximum strength with a minimum weight. The rear end of the frame consists of but a single tube, from which hang various supports for the motor, axle bearings and gearing. The body supporting springs, which are placed equi-distant along the frame, are pivot-

TESTING THE FRAME.

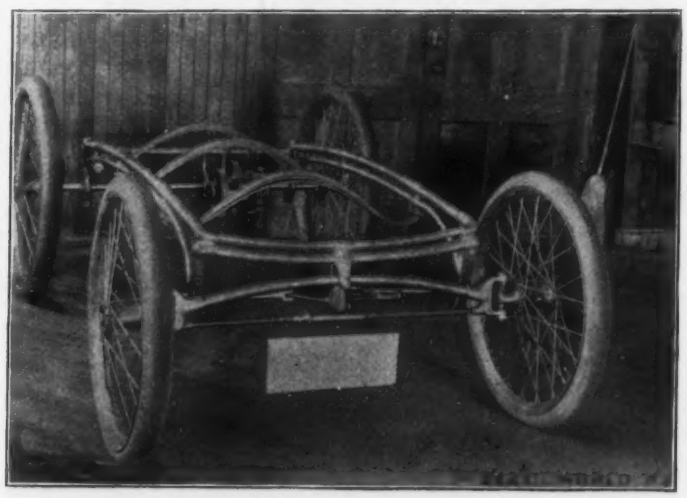
ally suspended at each end from the under side of the side tubes.

A particularly notable feature of the vehicle is the use of ball bearings in every possible instance and wherever any possible advantage would be gained by their use. Not only do all the axles and spindles revolve in ball bearings, but the motor armature and various pivots are also equipped in the same way.

For the operation of the carriage, three devices are provided, easily accessible to the operator, who sits on the left-hand side of the carriage. The vertically placed lever at the side of the seat is used for operating the motor controller. The nearly centrally placed handle rod, resembling in appearance an ordinary brake handle such as is used on street cars, is used for steering. At



FRAME AND DRIVING GEAR.



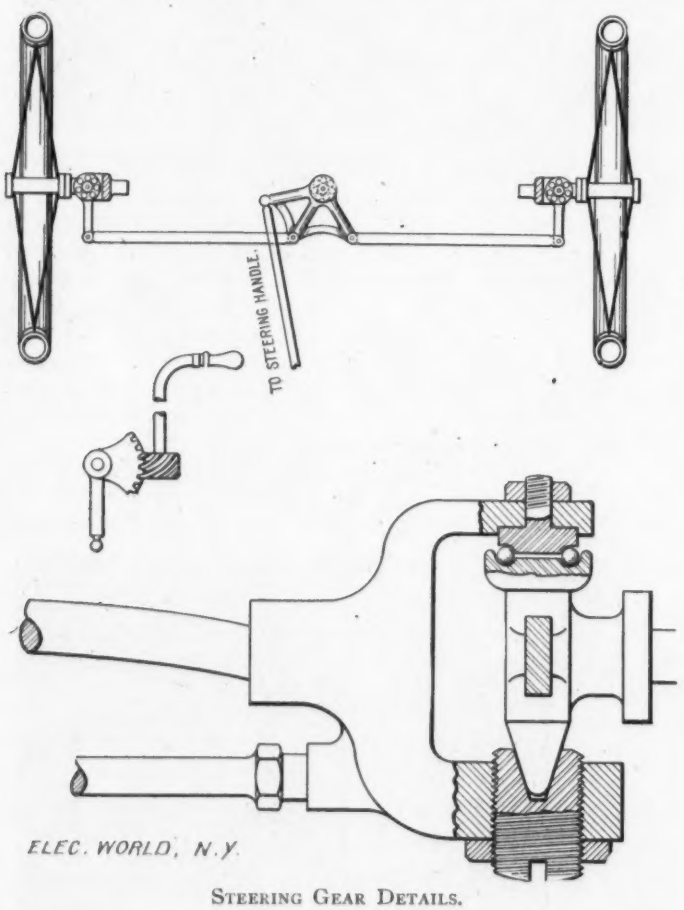
FRAME AND STEERING GEAR.

the bottom of the vehicle body close to the dashboard is a pivoted foot-operated lever, which is connected with the brake rod to apply the hand brake on the gear casing fitted to the axle. In conjunction with the operation of the controller lever a peculiar interlocking reversing switch is used, which is operated by means of a foot push, the action of which will be described later.

Probably the prime and particularly notable feature is the method of driving the vehicle, and the motor used for this purpose. The latter has been most carefully and specially designed and as manufactured under the specifications of the company consists of an ironclad casing which entirely surrounds the field windings and armature, and which is concentrically suspended upon the rear driving axle. The greatest care has been exercised in the design and construction of this motor to produce the highest possible capacity and the minimum of weight, and at the same time a moderate speed. The multipolar field of the motor has been built up of wrought iron welded by hand. The armature is of the Gramme ring type, current being taken from the commutator by means of two brushes, the windings being inter-connected. The field windings are in sections series connected to the armature. The commutator projects beyond the field magnet frame proper, which is of rectangular form and has at this side an aluminum casing, which completely surrounds the brush and commutator devices. One-half of this casing can be readily unhinged, giving access to the interior of the motor. The field frame is fastened at each side to a hanger from the rear frame tube. The armature is mounted upon a concentric sleeve around the driving axle, but is, however, entirely out of contact therewith, it being supported by means of ball bearings in the previously-mentioned hangers also supporting the field frame of the motor. The hollow armature sleeve projects through the bearing at the end opposite to the commutator and a pinion is fastened thereto, which, in turn, meshes

with a larger spur gear on an intermediate spindle, whose motion is then imparted to the balance of the driving gear, to which it is spur connected.

The two rear driving wheels are mounted on a revolving axle, which is split approximately in the centre and connected to the intermediate gear from the motor, previously mentioned, by means of a balance differential gear arrangement. The two outer hangers from the frame form bearing supports for the axle, ball bearings being used, the compactness of which is to be particularly noted. The balance gear used is of the ordinary so-called "Jack-in-the-box" form, consisting of two balanced bevels, one connected to each of the driven members, while the cenrtally driven portion consists of two diametrically opposite bevel pinions rotated in the plane at right angles to that of the side balance gears, with which they mesh. The peculiar construction adopted in this instance consists of an outer casing, the exterior of which serves as a brake pulley as well, and to one side of which the spur gear is fastened, coacting with the intermediate driving shaft. To the interior of the casing is fastened the central portion of the balance gear, and on each side are the driven balance members, the axle being separated about in the centre of the casing, and one of these members being fastened to each end. It will be noted that the axle is additionally supported, aside from the two outer bearings, by means of a ball bearing on each side of the balance gear. The difference in travel of the inner and outer driving wheels in turning curves necessitates the adoption of such balance gearing, owing to the propulsion of both wheels by a single motor, whose operation, it is claimed, far exceeds in effectiveness the use of

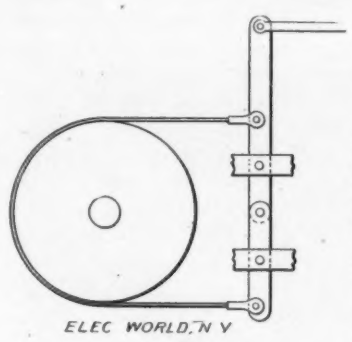


Steering Gear Details.

double motors. The entire gearing is enclosed, but is yet accessible by means of detachable covers in the gear casing.

The vehicle wheels are of the tangent spoke steel rim construction, and are fitted with 3-inch single tube pneumatic tires. The driving wheels are 36 inches, the steering wheels 32. The wheel track is 54 inches, and the distance between the wheel bases about 6 feet.

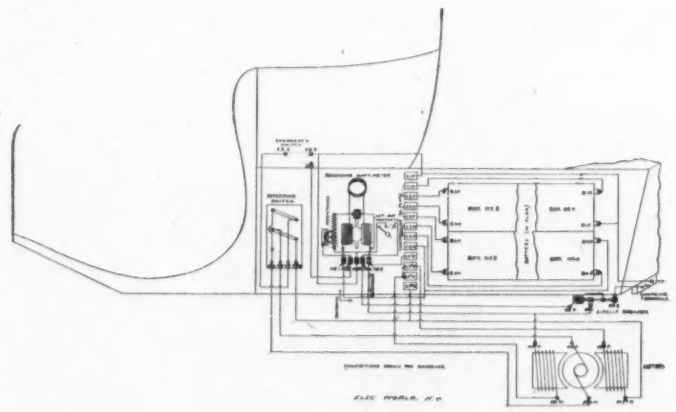
The brake adopted is of the band type, and of a most unique construction. It consists of a compound steel and leather band surrounding the brake pulley balance gear casing previously mentioned. The brake band is arranged to operate equally well when the brake pulley is driven in either direction. Both ends of the band are, therefore, moved to set the brake in action, which is accomplished through a compound lever arrangement, each end of the brake being fastened to separate levers, which interlock so that the operation of one, to which one end of the brake is connected, also moves the other end of the brake band attached to the other lever in the same direction. The operation of the brake by means of the braking foot-lever is by the direct action of a rod, connecting the two parts.



Brake Details.

The front steering wheels of the vehicle are pivoted to a horizontal axletree, which is in turn centrally pivoted to the truck frame, in order to permit of vertical oscillations of the wheels in passing over obstructions on either side. The method of steering that has been adopted is what is known as the short-nut pivoted axle method. Each end of the axletree, which is also built of steel tubing, is a forked forging. Each of the steering wheels revolves on ball bearings on a short axle pivoted to the axletree forks very close to the wheel hub. The strain at this pivot is taken up by ball bearings in the upper pivot. An arm projects from the pivoted portion of the axle at approximately a right angle to the wheel centre, and each is connected by means of a pivoted tubular rod to one arm of a three-armed forging, pivoted on ball bearings at the junction of the arms to the centre of the axletree. The other arm is connected in turn with the previously mentioned steering handle, which has at its lower end, projecting through the floor of the carriage, a spiral gear meshing into a suitable gear segment at one end of a pivoted lever, the other end of which is connected by means of a rod to the arm on the triangular steering lever previously mentioned. By the peculiar arrangement of this steering device the wheels, in turning curves, are turned at different angles, so as to prevent the scraping of the wheel tires. The operation of the steering wheels by the hand is exceedingly easy and rapid, a slight turn to the right or left being all that is necessary under ordinary conditions.

The storage-battery equipment consists of forty-four chloride cells, arranged in four sets of eleven each, which are fitted in two sliding boxes, and can easily be placed in or taken out of the box through the hinged door at the rear. These cells are specially sealed and are almost entirely proof against any spilling. The storage-battery equipment weighs 850 pounds, and is of the type known as the 3-M cell, which is made up of three plates, two of which are negative. After a long series of tests the chloride positives and negatives have been adopted. The battery has a capacity of 70 ampere hours at a discharge rate of 25 amperes. At this rate, the battery will run for about thirty miles of travel at the rate of twelve and one-fourth miles per hour. This traveling capacity has been found amply sufficient, after a series of extensive observations.



Electrical Connections

To operate and control the batteries and motor a cylindrical controller is used, which is arranged to interlock with separate

foot-operated reversing switch mechanism. The controller cylinder, on which various contacts are mounted, is turned by means of the operating lever. Connected to the spindle, upon which it is mounted, is a cam which coacts with certain stop levers connected to the reversing switch. The reversing switch in its normal position is set for forward operation of the carriage, and by means of the controller four speeds can be obtained, three miles an hour being the lowest speed, when the four sets of batteries are connected in multiple. The next step on the controller connects two sets in series and the two pairs in multiple, which gives six miles an hour. Twelve and one-quarter miles an hour is obtained at the next step, which connects all the batteries in series, and the highest speed of fourteen and three-fourths miles an hour is obtained by throwing the series motor field windings in parallel with each other. If it is desired to reverse the direction in which the vehicle is moving, the operating lever must first be brought back to its normal all-off position before the reversing switch can be operated. After the lever has been brought back a foot-lever at the side of the seat is pressed downward, throwing over the reversing switch to suitably connect the motor and give an opposite rotation. After this has been accomplished, the controller lever can be again operated and another of the previously mentioned speeds can be obtained in the reverse direction. When the controller lever is returned to its normal position the reversing switch automatically returns to the forward contacts. By this arrangement it is impossible to overload the motor by suddenly reversing its connections while going in either direction.

Near the seat is placed a small plug switch for emergency purposes, which can be easily pulled by the operator in case of accident to the motor which would prevent it stopping otherwise.

Another device which further decreases the liability of injury through ignorance, and makes the complete vehicle more or less fool-proof, which has been the particular aim, is the automatic charging and discharging controlling mechanism. To charge the batteries, a flexible conducting cable of suitable length is furnished with the vehicle. One end of this cable is fitted with plugs of different diameters which fit in their receptacles placed at the rear end of the vehicle immediately below the battery. The batteries are arranged to be charged from an ordinary 110-volt direct-current circuit, which is almost everywhere available, suitable resistance being provided, and it is only necessary to connect the charging cable to such supply wires and plug in each of the terminal plugs, it being impossible to make any mistake, owing to the difference in size of each set of plug and receptacle. Immediately under the seat is a small opening through which can be seen the dial of an automatic recording wattmeter. This instrument is arranged to protect the batteries from over-charging and over-discharging. In charging the batteries, as the charge gradually increases, the movement of the wattmeter brings the dial pointer upward until the maximum point is reached, when a contact is automatically made controlling a magnetic switch which automatically disconnects the batteries from the circuit, should the operator have failed to notice the indicator pointer. In discharging the batteries, the wattmeter operates reversely and indicates by the pointer on the dial the remaining charge in the batteries. The dial can easily be seen by the operator without moving from his seat.

The diagram herewith shows the general arrangements and connections of the various electrical apparatus used to control and operate the vehicle. An inspection will readily show the thoroughness with which every detail has been worked out in order to make the vehicle almost entirely automatic, by means of self-operating devices and to guard against mistakes of any kind being made by persons who may be excited or unfamiliar with the functions of the various parts. It is to be noted that this entire arrangement is covered by patents. A peculiarly interesting feature is the fact that all connections throughout the carriage which have to be manipulated in any way, are made of two different sized plugs and holes, all of the positives being the larger. A mistaken connection is, therefore, impossible.

The complete carriage weighs about 1900 pounds, and traveling at twelve and one-fourth miles per hour with two occupants, consumes about eighteen amperes at eighty volts, the latter being the voltage of the battery when all the cells are in series. Under such conditions the motor will have an output of about 1.93 horse-power. It will operate continuously for thirty miles at an efficiency of about 80 per cent. A particularly notable feature of the motor, however, is the fact that although its rated capacity is 2 horse-power, it readily stands 100 per cent. overload for half an hour without excessive heating. When it is considered that the motor weighs complete only 120 pounds and has a speed of only 1000 revolutions, this is a phenomenal performance, and is certainly due to the particular care taken in the construction.

A description of the vehicle would not be complete without a mention of Mr. H. P. Maxim, son of the renowned inventor of that name, to whom the design of all the electrical features and many others used in the construction of the vehicle are due. As showing the thoroughness of construction and the desire to prevent any future possibilities of accident to the mechanism, the test made of each vehicle should also receive attention. No better description can be given thereof than the illustrations shown. The vehicle at full speed is run over the obstructions shown on one side. It is then also run at full speed over a number of timbers fastened to the factory floor. After this most extreme performance the alignment of all bearings and the condition of the frame and mechanism generally is tested and leveled, and if found in the slightest way deficient the construction is rejected. This test is made before the carriage body is completely finished.

On Thursday at the demonstration, at which all those who were present were permitted to operate the vehicle, it was clearly shown that as far as ease of operation and perfect control are concerned the vehicle met all reasonable requirements.

Preliminary Note on a Form of Portable Autographic Recording Meter.

BY HERMANN S. HERING.

The desirability and, in fact, necessity of having electric meters producing autographic records for use in experimental research, electric traction and central station work has long been appreciated and often been expressed in the journals and at meetings. Especially is there a demand for an instrument making a graphical record of rapid changes such as are met with in electric traction work, and obtaining simultaneous records of the various quantities involved.

The nearest approach to curves showing the variation of current, etc., have been obtained by plotting readings taken at short intervals of time or distance, which however approximately approaching the average in the long run, are nevertheless inaccurate.

In determining the performance of electric cars the following quantities are required: The location of the car (by pole number or

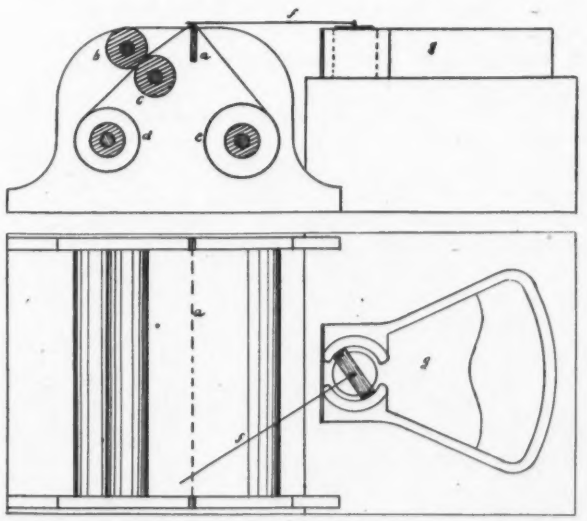


FIG. 1.—PLAN AND ELEVATION, AUTOGRAPHIC RECORDING METER.

stake), grade (in per cent.), character of track (straight or curved, and if curved the value of the curve); time; speed; current in individual motors and in the trolley; potential difference at the car, and at the station if desired; electrical horse-power or kilowatts at the car and at the station if desired; and draw-bar pull.

The author, in making such tests* during the past five years, felt the lack of recording instruments keenly. The two or three

* "Test of the Neversink Mountain Electric Road," ELECTRICAL WORLD, May 28 to July 30, 1892. "Electric Car Tests," *Electric Railway Gazette*, August 31 to November 16, 1895.

forms of meters on the market producing a graphical record are all limited to moderately steady conditions, are not portable, and therefore would be utterly useless on board an electric car, or in many cases even in electric traction power houses. The commercial recording wattmeters registering the quantities on dials are suitable only for obtaining totals for a time interval and averages; and they are very useful in such a capacity.

The requirements to be met by instruments for electric traction work are: (1) Prompt action; (2) aperiodicity; (3) accuracy; (4) clear record, easily read; (5) portability; (6) accessibility for calibration, adjustment and repairs, and (7) economy. These requirements preclude all but the dead-beat instruments, which in fact are limited to the d'Arsonval form. The record must be produced by a frictionless method, otherwise the action will be sluggish and uncertain. For ease of interpretation the record should be on a paper ruled in a simple manner and with straight-line ordinates.

At a meeting of the Electrical Section of the Franklin Institute, held January 5th, 1892, the author described a form of instrument designed to meet these requirements as nearly as possible, but owing to lack of time the instrument was not developed. During the past year, however, some records were obtained which are encouraging, and it was thought that a brief description of the method, together with some preliminary results, might prove interesting.

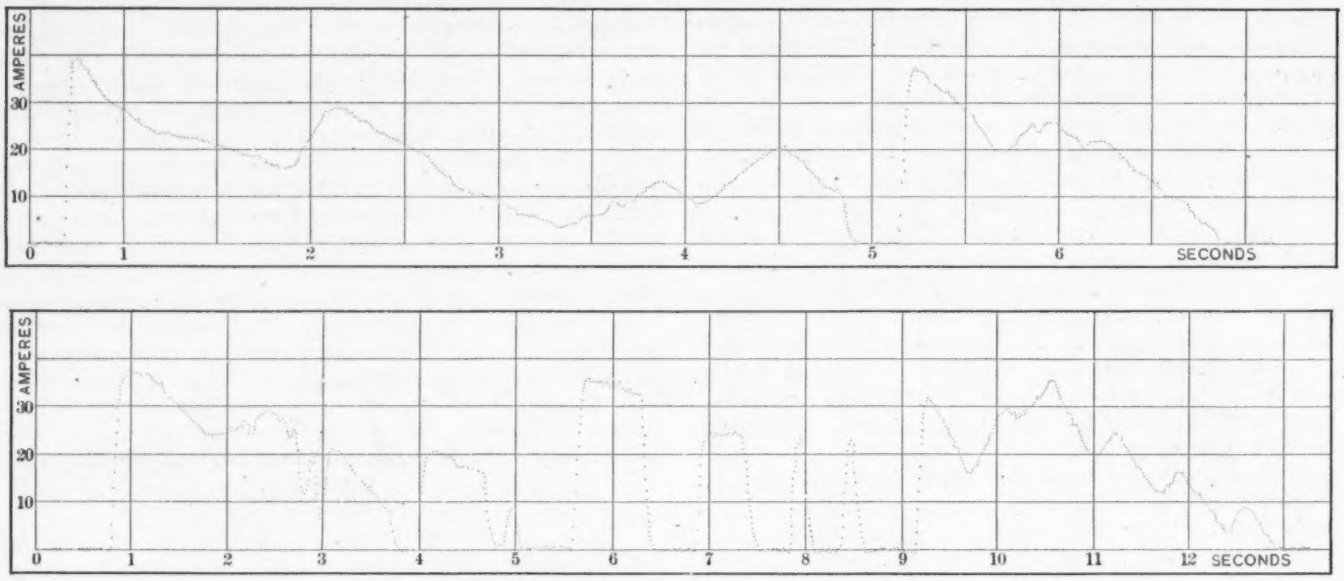
The record is obtained by passing sparks of moderately high frequency from a pointer through prepared paper, thus producing a frictionless record. In order to obtain straight-line ordinates the paper is passed over a knife-edge forming a chord of the arc described by the pointer. The paper is operated by means of rolls and a driving mechanism, which can either be driven from the car axle or by clock. The seconds can also be recorded from a clock by means of an extra spark or stamping below the record. As the Weston instruments fulfill all the requirements for a portable measuring instrument they are especially suited for this purpose.

Figure 1 shows the elevation and plan of the instrument in outline. *b* and *c* are pressure rolls driving the paper, and are driven from the car axle or a clock mechanism. *d* and *e* are rolls on which the paper is wound and unwound, driven by a friction wheel geared to *b* or *c*. *g* is a Weston instrument, of which *f* is the aluminum pointer. *a* is the knife-edge over which the record paper passes. *f* and *g* are connected to the secondary of a small induction coil.

Figures 2 and 3 are sample records obtained from an autographic recording ammeter. In the record of Figure 2 the paper has a velocity of one inch per second, and in Figure 3 twice that amount. The record is perfectly legible and permanent, and can be greatly improved by a better adjustment and with more favorable conditions than those available during these preliminary experiments.

The difference between the value of the ordinates along the arc and its chord is small, but to make the record correct the paper can readily be ruled with horizontal lines in the proper position, which is not as objectionable a feature as having curved ordinates. The best results were obtained with paper coated with a solution of cadmium chloride, as the spark produced a distinct record of a brown color that was permanent. The paper could be used dry, and need not be freshly prepared, which is a great advantage.

The plan of the author is to use a number of Weston instruments placed alongside and calibrated from their various records, so that they can all be made on the same sheet and on the same base. The paper can be driven either by a clock, in which case the records would be on a time basis, or else by a connection with the car axle, in which case they would be on a distance base. The amperes, volts and watts can be recorded directly, and the speed, grade, curvature and dynamometer pull by means of voltmeters or milliamperemeters suitably arranged, or by other methods. The speed of the paper could be varied to suit the character of the work. For a study of rapid variations for a short time the paper should run at about one or two inches per second, and for more steady conditions, a longer distance or time, perhaps an inch or so per minute.



Figs. 2 and 3.—Specimen Autographic Records.

The author desires to express his obligation to the Weston Electrical Instrument Company for the loan of two of their instruments for this work; also to Mr. G. S. Maynard and J. H. Gordon, Jr., for their assistance in conducting the experiments in the laboratory.

The Canadian Electrical Association.

The programme of the seventh convention of the Canadian Electrical Association, which will be held at Niagara Falls, Ont., June 2, 3, and 4 next, has just been issued. The following-named papers will be read:

"Day Loads for Central Stations and How to Increase Them," J. A. Kammerer, Toronto; "Submarine Cables; Dealing More Especially With the Actual Experience in Cable-Laying and Maintenance in This Country," D. H. Keeley, Ottawa; "Determination of the Heating Power and Steam Producing Value of Coal, from a Preliminary Examination," William Thompson, Montreal; "Water Driven Plants," John Murphy, Ottawa; "The Commercial Aspect of Electric Railways," C. E. A. Carr, London, Ont.; "Accumulators: Their Application to Central Station Lighting and Power," W. A. Johnson, Toronto; "Why Some Lighting Plants Do Not Pay," F. C. Armstrong, Toronto; "Steam End of an Electric Plant," A. M. Wickens, Toronto.

Among the social features of the meeting will be an excursion to Buffalo over the Niagara Falls Electric Railway, where a visit to the power house of the Buffalo Railway Company will be made; a banquet at Dufferin Cafe, at 8 P. M., June 3, and visits to the various places of interest at and about Niagara Falls, on both sides of the river.

An Experiment in Electric Traction on the New York, New Haven & Hartford Railroad.

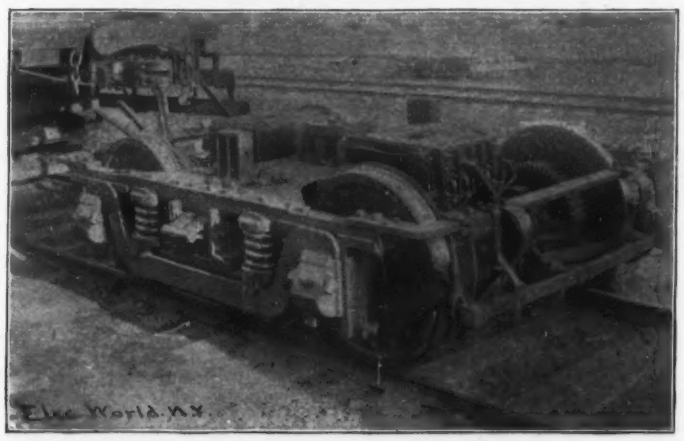
The New York, New Haven & Hartford Railway directorate has made another advance in the application of electricity in the operation of its road in the electrical equipment of its line running from Berlin to New Britain on the New Haven system, Hartford division, and from New Britain to Hartford, on the New England system, Springfield division.

The first car was officially run over the electrically equipped track on the 11th inst., by Col. N. H. Heft, the chief of the electrical department of the N. Y., N. H. & H. R. R., in the presence of the president, C. P. Clark, vice-presidents Hall and Mellen, the directors and other prominent officials of the New Haven and New England systems.

The importance of this step can hardly be gauged. Unlike the experiments at Nantasket and East Weymouth this length of the

ONE OF THE MOTOR CARS.

newly equipped lines gives it an appearance of permanence which removes it from the region of experiment, and while it is still difficult to predict with any assurance of immediate realization the supersession of the steam locomotive, the successful operation of this line from the points of view both of electrical efficiency and



A 125 HP MOTOR TRUCK.

financial economy will go far toward hastening the day when the steam locomotive will be relegated to the limbo of half remembered though faithful servants.

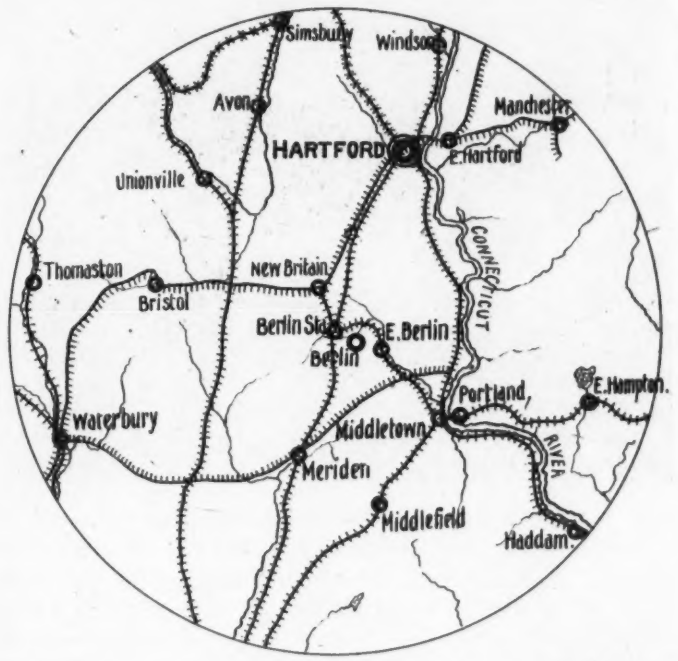
This is the longest section of any railroad in the world, hitherto exclusively operated by steam locomotives, to be equipped for electric traction. The total distance is 12.3 miles, divided in two parts — the first running from the power house at Berlin, the second extending from New Britain to Hartford. The road from Berlin to New Britain is single track; from New Britain to Hartford double track, the eastbound track only being devoted to electric service.

In the operation of this road the electric trains will run from Berlin to New Britain and back, the trains from New Britain to Hartford and return running as a separate service, the change of cars being made at New Britain.

This important system differs in its electrical equipment from that at Nantasket in that the trolley system of contact is not used.

That adopted is the third-rail system, the conductor or third rail being laid along the centre of the track between the running rails.

This power station of the New York, New Haven & Hartford Railroad is No. 3, that at Nantasket being No. 1, and No. 2 being the power house at Stamford, from which the local trolley line is supplied with current. Power station No. 3 is a brick and stone building, two stories high, divided by a central wall into two parts —boiler room and engine room. In its present condition it forms only about half of what the station will ultimately be. The north side is closed in by boards. At what will be the centre of the front wall of the completed building is a bay in which the switchboard is erected. The present length of the building is 113 feet 3 inches, its depth exclusive of the bay 102 feet 5 inches, and height



RAILWAY LINES AND TOWNS NEAR BERLIN 35 MILES DIAMETER.

to ridgepole 65 feet. It is divided by a 26-inch brick wall into two parts, the front part facing the railroad being the engine room. The rear contains the boiler equipment.

The boilers are ten in number, each of 300 horse-power. They are of the tubular pattern, built by E. Kendall & Sons, Cambridgeport, Mass., and are set in two batteries of five each. In the construction of the boiler front a new method, devised by Col. N. H. Heft, chief of the electrical department of the Consolidated road, who has carried out the entire electrical installation, is followed. The entire boiler front is capable of being taken down without disturbing the rest of the boiler setting, the front being bolted to a plate attached to the dividing wall instead of to the wall itself. This innovation will be readily appreciated.

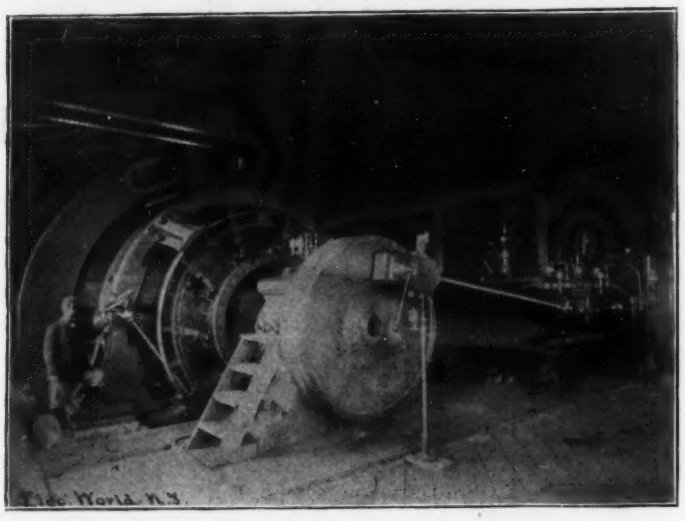
There are two feed water pumps, either pump being capable of supplying water to both batteries at once. The piping from the boilers is in duplicate and will be covered with non-conductive covering. The flues enter a brick stack 125 feet high, located immediately in the rear of the centre of the present building. The coal used is known as locomotive sparks, the burning of which has given considerable satisfaction at the Stamford station. The coal is taken directly from the trucks in the rear of the station and is emptied into a large bin running along the back of the building.

The engine section of the building is divided into two stories, the upper one of which will contain the engines and dynamos. It is lighted by windows both in front and at the side, and is very high,

spacious, and well ventilated. One engine is in place, the foundations are in for another, and a third will be added as soon as demand warrants.

The projected extension of the building will hold three more, and as each engine will have a capacity of 1200 horse-power, the total capacity of the station when completed will be 7200 horse-power, nominal, which can readily be raised to 12,000 horse-power. The engine at present in position is a Greene-Corliss improved cross-compound, condensing, built by the Providence Steam Engine Company. It is rated at 1200 horse-power, nominal, with dimensions 28 x 48 x 48 x 4-foot stroke, running at 100 revolutions per minute.

To the engines is directly connected a General Electric standard 10-pole 350-kw generator of the ironclad type, with the method of construction of which our readers are familiar. The dynamos are over-compounded and furnish current at 600 volts, no load, and 650 volts full load. The switchboard in the bay is of the G. E. standard panel type, built up of seven panels, four of which are at present blank. Of the three equipped, two are generating panels, while the third is a totalizing panel. The first two carry automatic circuit breakers, with magnetic blow-out, ammeter and the usual generator panel equipment, the totalizing panel carries a form G Thomson



One of the 1200 HP Generating Units.

recording wattmeter, showing the total output from the generators. A traveler with two cranes, one of thirty-five tons, the other of five tons capacity, runs the length of the engine room. It was built by the Berlin Iron Bridge Company, which furnished the steel roof trusses.

From the switchboard run four cables each of 850,000 circular mils cross-section to the third rail.

The third rail is similar in shape and weight to that used on the stretch of track between East Weymouth and Nantasket Junction on the South Shore Branch of the Plymouth Division of the N. Y., N. H. & H. R. R. In cross-section it resembles a flattened "A" and weighs ninety-three pounds to the yard. It is laid upon blocks of wood impregnated with insulating material. The blocks are only about one-half as high as those used at East Weymouth, allowing one and five-eighths inch from the eave of the third rail to the tie, and in some places only one and one-half inch. This reduction in the size of the insulating block is due to the fact that no greater height could be allowed in view of the height of the service rails.

The top of the third rail is about one inch higher than the level of the tops of the running rails. The conductors are bonded, not by the ordinary leaf or stranded copper bond, but by plates of sheet copper one-eighth inch thick, twelve inches long and four and one-half inches wide. These are fastened to the under side of the third rail joints by means of a drop-forged iron angle-plate bolted by sixteen bolts, eight for each copper plate, on each side to the third rail joint, the nuts being outside the rail. Each bond has a capacity of about 900,000 circular mils, the total bond at each joint having about twice the carrying capacity of the rail itself, while its measured resistance is less than equal length of the 93-pound third rail. One of the most striking facts in this installation is the absence of feeders, entire independence being placed on the carrying capacity of the well-bonded rail.

On the Berlin branch are four grade crossings. On the New Britain and Hartford line eighteen. At all of these crossings the third rail is omitted, the circuit being continued underground by stranded bare copper cables of 500,000 circular mils, and in some cases 850,000 circular mils. These cables are first drawn into creosoted wooden conduits filled with an insulating material made of residuum and asphalt. They are then laid in creosoted wooden troughs in turn filled with the same compound and then boxed over and buried. The broken ends of the third rail are fitted with wooden inclines or approach blocks to allow the shoe to rise upon the rail without danger of catching and breaking.

The motor equipment will consist at first of five motor cars. These are open cars fifty feet in length, used last season at Nantasket, but deprived of the trolley. Each car weighs about thirty-two tons. Each is equipped with two G. E. 2000 motors, and two-series parallel controllers. The car cut-out is a K automatic circuit breaker fixed beneath the hood. Each motor car is fitted with air brakes, two gongs and a chime whistle.

Air for the brakes and whistle is furnished by a vertical double-cylinder air pump, driven by a motor automatically controlled by special switch which is opened when the pressure in the main tanks reaches ninety pounds, and closed when it falls below that.

Contact is made with the third rail by means of sliding shoes. These are of cast iron twelve inches long and four inches wide, weighing about twenty pounds. They are suspended by two links from a casting fastened to a beam set immediately beneath the king-pin of each trunk, connection between motor and shoes being made by flexible cables. The distance between the two shoes is about thirty-three feet.

Many of the grade crossings are wider than this, and to avoid carrying the train over the crossing by momentum another shoe is fitted for each truck of the second car of the train, a connection running from this shoe to the motors. Thus, by the time the last shoe has left the third rail at one end the first shoe is in contact with the next section of the rail.

The question of the safety of the public was not the least important which demanded the attention of the officials of the New Haven road. In order to protect it from its own foolishness or absence of mind, the greatest precautions are taken. At Berlin and Hartford stations the third rail section is fenced in on both sides. At New Britain, where the lines of the New Haven and New England systems converge, in addition to the fence a method which almost amounts to interlocking is adopted. In the "Y" formed at the convergence of the roads is the switchman's tower. From the section of the rail entering the station cables run underground to a switchboard in the tower, for which the third rail may be connected to or disconnected from the circuit. As the train comes to a stop in the station, the third rail is cut out, and is not thrown into circuit again until the outgoing train is ready to start. The chance of accident is thus reduced to a minimum.

Credit for this installation must be awarded to President Clark for the courageous advance he has made in the application of electricity to travel on the steam line; to Col. N. H. Heft, the practical chief of the electrical department, who laid out and supervised the installation at Nantasket, East Weymouth and Berlin, and to the General Electric Company, whose long experience and perfected apparatus rendered the installation possible.

The Energy in Röntgen Rays.

Prof. John Trowbridge, of Harvard, made some experiments recently to measure the energy represented by Röntgen rays, and found that at the moment of the emission of these rays the energy was not far from 3,000,000 horse-power, acting for one-millionth of a second. Less than 100,000 volts did not seem to produce any rays, and the discharges when rays are produced were found to be oscillating in character.

Annual Meeting of the German Electrical Society.

The fifth yearly meeting of the Verband Deutscher Elektrotechniker is to be held from the 10th to the 13th of June at Eisenach, Germany.

Alternating-Current Machinery.—IX.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

INDUCTANCE IN ALTERNATING CURRENT CIRCUITS.—*Continued.*

83. When an iron core is introduced into an active coil, the total amount of flux linked with the coil becomes greatly increased, and, consequently, the inductance of the coll is correspondingly increased.

This increase in the amount of flux, by the introduction of the iron, is due to the fact that the iron adds its own magnetic flux to the flux produced by the active coil. Under these circumstances, however, the inductance of the coil is no longer a definite quantity, but varies with the strength of the current circulating around the coil. When no iron core is used, the magnetic flux linked with the coil increases directly with the current, and consequently, the ratio of flux linkage to current strength is a constant quantity, and the inductance is independent of the current strength. When, however, an iron core is inserted, the magnetic flux linked with the coil is no longer proportional to the current strength. When the current strength increases, the flux, after a certain critical value has been reached, falls off considerably, and a further increase of current is attended by a comparatively small further increase of magnetic flux. In other words, the iron is said to be approaching magnetic saturation. The ratio, therefore, of magnetic flux to current strength in coils containing iron varies with the current strength employed. This is particularly the case when the iron core is closed upon itself, so as to form a complete or ferric-magnetic circuit. For this reason the conception of inductance is of far less practical value in dealing with alternating current apparatus containing ferric magnetic circuits, such as alternating current transformers, than in dealing with circuits containing no iron, such for example, as overhead conductors. When, however, the range of current strength passing through the coil is comparatively small, and particularly when the iron core of such a coil is far from being saturated, the inductance of the coil does not vary markedly through a moderate range of current.

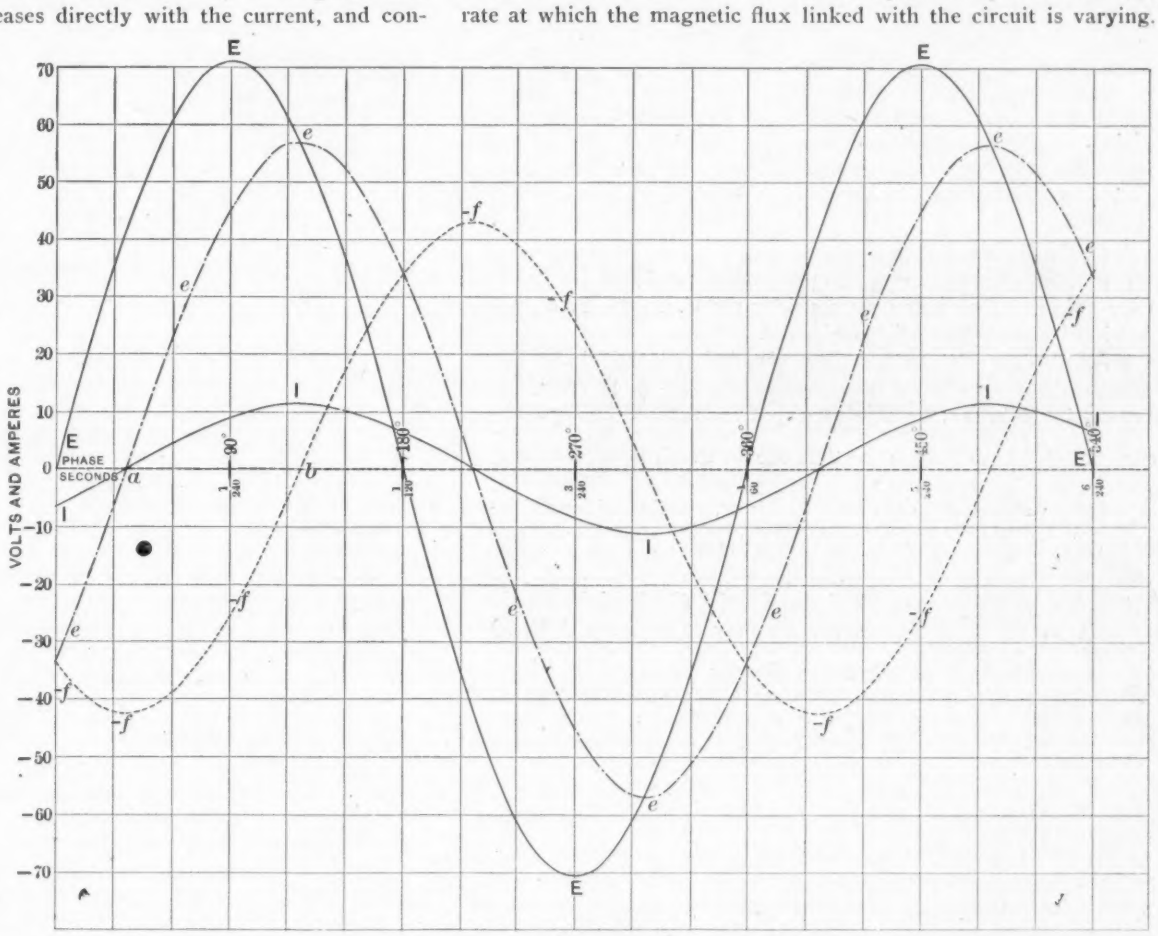


FIG. 54.

84. The following examples of inductance in practical apparatus may illustrate the above principles.

The inductance of an ordinary Bell telephone receiver, having a resistance of about 75 ohms, is usually about 75 to 100 milli-henrys, while the inductance of the telephone call bell, having about the same resistance, is often more than one henry. The telephone coil has a comparativly small inductance because its magnetic circuit is largely composed of air, and the magnetic flux linked with the coil is comparatively small. The call-bell has a comparatively large inductance because its magnetic circuit is almost wholly composed of iron, and the magnetic flux linked with the coil is comparatively great.

85. The inductance of any coil of wire not possessing an iron core is, therefore, a fixed quantity; *i. e.*, a definite number of centimeters or of henrys. It is a quantity which may be very difficult to compute, since the geometrical distribution of the magnetic flux passing through the coil may be very difficult to determine. It may, however, be readily measured in a variety of ways. The inductance of a coil possessing an iron core is no longer a fixed quantity, but depends upon the current strength, and unless the magnetic intensity in the iron is very feeble, the inductance of the coil diminishes as the current strength is increased. So long as the current strength flowing through a stationary circuit remains constant, the magnetic flux linked with the circuit also remains constant. There is, therefore, no E. M. F. induced in the circuit by this flux. If, however, the current strength in the circuit varies, then the amount of flux linked with the circuit varies, and this variation in the quantity of flux linked with the circuit induces an E. M. F. therein (¶ 32).

The value of this E. M. F. will be equal at any instant to the rate at which the magnetic flux linked with the circuit is varying. If we assume that there is no iron linked with the circuit, the rate of variation of magnetic flux will be exactly proportional to the rate of variation of the current strength, so that the self-induced E. M. F. or the E. M. F. of self-induction is exactly proportional to the rate of variation of current strength from moment to moment.

86. For example, if we consider a *non-ferric circuit* (a circuit containing no iron) with a total inductance of say 0.1 henry, and that this circuit carries a current which advances uniformly from 0 to 5 amperes in 10 seconds of time, then we know that since 0.1 × 100,000,000 webers = 10,000,000 webers are linked with the circuit when the current of one ampere flows through it, there will be 5 × 10,000,000 webers = 50,000,000 webers linked with the circuit when 5 amperes pass through it. This quantity of flux has been linked with the circuit uniformly in 10 seconds of time, or at the rate of 5,000,000 webers per second. Since one volt is produced by a linkage of 100,000,000 webers per second, the E. M. F. of self-induction, which has been developed in the loop by establishing this current, is 5 ÷ 100 volt and has lasted the entire 10 seconds. This E. M. F. may be otherwise expressed as the inductance, 10,000,000 webers-per-ampere, multiplied by the current strength, 0.5 amperes. The rate of increase of current or the E. M. F. of self-induction in a non-ferric circuit is the product of the inductance and the rate of change of current. In symbols this is expressed as $e = l\frac{di}{dt}$ where e, is the E. M. F. of self-

nduction in volts, 1, is the coefficient of self-induction, or inductance in henrys, and $\frac{di}{dt}$ is the instantaneous rate of change of current in amperes-per-second. Since, however, the E. M. F. e, of self-induction is always opposed or counter to the E. M. F. which produces the change of current in the circuit, e, is always opposite in sign to the active E. M. F. or is a counter-electromotive-force (C. E. M. F.).

87. In the case of a continuous-current circuit, in which the current remains steady after being once started, the inductance of the circuit is seldom of any practical consequence, because it is only when the current is started that the C. E. M. F. of self-induction is developed, and the circuit then behaves as though it had no inductance. Under these circumstances, Ohm's law deals with the resistance of the circuit and the E. M. F. acting thereon. In the case, however, of an alternating-current circuit, the current is necessarily continually varying, and consequently the inductance of the circuit plays a prominent part, since a counter E. M. F. of self-induction is continually being thereby induced in the circuit, and this C. E. M. F. plays a prominent part in all alternating-current circuits. The value of the C. E. M. F. of self-induction in an alternating-current circuit depends upon the inductance of the circuit and upon the type of the current wave. It is, moreover, more complex when iron is linked with the circuit. Dismissing at the present time the more complex effect produced by the presence of iron, we may now consider the C. E. M. F. of self-induction induced in non-ferric circuits.

88. If the current strength in a circuit is sinusoidal the rate of change of this current is also sinusoidal. (¶ 42) Thus, if the current $i = I \sin \omega t$, we have seen that the rate of change of this current is $\frac{di}{dt} = \omega I \cos \omega t$, so that the C. E. M. F. $l \frac{di}{dt} = l \omega I \cos \omega t$ volts. But $\cos \omega t = \sin\left(\omega t + \frac{\pi}{2}\right)$; or, a cosinusoid is a sinusoid advanced in phase by 90°. Consequently the C. E. M. F. $l \frac{di}{dt} = l \omega I \sin\left(\omega t + \frac{\pi}{2}\right)$ volts. But a C. E. M. F. is oppositely directed to an E. M F., so that we may regard the C. E. M. F. $l \frac{di}{dt}$ as an E. M. F. of negative sign or an E. M. F.

$$-l\frac{di}{dt} = -l\omega I \sin\left(\omega t + \frac{\pi}{2}\right) \text{ volts.}$$

$$= l\omega I \sin\left(\omega t - \frac{\pi}{2}\right) \text{ volts (¶ 62).}$$

Consequently the E. M. F. of self-induction of a sinusoidal current is a sinusoid of $l\omega$ times the amplitude of the current, and lagging 90° behind the current in phase.

89. As an example, we may consider the case of an active alternating-current transformer, which is supplied with a sinusoidal alternating pressure of 50 volts effective at its secondary terminals, and at a frequency of 60 ~. If the secondary circuit be closed through a non-ferric inductance coil, having a resistance of 5 ohms, and an inductance of 10 milli-henrys, then we shall see later that the current strength in the inductance-coil will be, approximately, 8 amperes effective, and lagging 37° 1′ behind the secondary pressure

Fig. 55.

in phase. Consequently the current may be expressed as:

$$i = 11.29 \sin (2\pi \times 60 \times t - 37^\circ\ 1')$$ amperes

$$i = 11.29 \sin\left(377\, t - 37^\circ\ 1' \times \frac{\pi}{180}\right)$$

when the angle is expressed in radians (¶ 18); or,

$$i = 11.29 \sin (21{,}600^\circ\, t - 37^\circ\ 1')$$

where the angle is expressed in degrees. Fig. 54 shows the sinusoidal impressed E. M. F. E, of 50 volts effective, or, $50 \times \sqrt{2} = 70.7$ volts amplitude, starting positively at $t = 0$ seconds, and completing its cycle in $t = \frac{1}{60}$ second. The current I, starts positively at a, 37/21,600 second later, or 37° behind E, in phase. It has an amplitude of 11.29 amperes, or an effective value of 8 amperes. The rate of change of this current multiplied by l (0.01 henry) would give a sinusoid of $0.01 \times 377 \times 11.29 = 42.56$ volts amplitude, 90° in advance of I. This C. E. M. F. represents an E. M. F. of 42.56 volts amplitude, 90° behind I. This is the E. M. F. of self-induction, and is plotted in Fig. 54, as the sinusoid f, which starts positively from zero at b, 90° later than, or behind I.

The inductance coil of 5 ohms resistance is, therefore, subjected to two E. M. F.'s; namely, the impressed E. M. F. E, and the self-induced E. M. F. f. It is, therefore, subjected to the sum of these

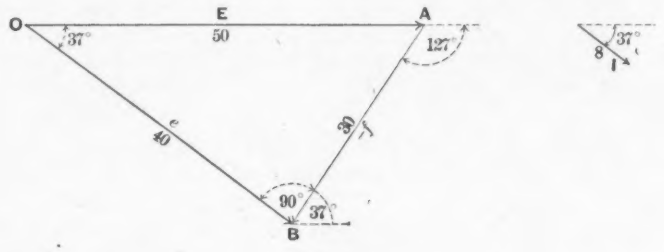


Fig. 56.

two. Summing E and f, algebraically in Fig. 54, we obtain the sinusoid e, which is 37° 1′ behind E, in phase, or starts positively from zero later by the time oa than does E. We may therefore regard the resultant E. M. F. e as the only E. M. F. acting in the circuit. Its amplitude is 56.45 volts, and its effective value $56.45 \sqrt{2} = 40$ volts. This E. M. F. will produce, through 5 ohms resistance, a current of $40/5 = 8$ amperes effective exactly in step with it. Thus in Fig. 54, the resultant E. M. F. e is in phase with the current I, and both are 37° 1′ in phase behind E.

90. The effect, therefore, of the inductance of 0.01 henry in the 5-ohm coil has been to reduce the current strength under a pressure of 50 volts from $50/5 = 10$ amperes to, approximately, 8 amperes, and to retard the phase of this current by approximately 37°. The coil apparently offers a resistance of 6.25 ohms instead of 5 ohms. In other words its *apparent resistance* is no longer the ohmic resistance of 5 ohms which it would offer to steady currents, but 6.25 ohms. This apparent resistance is called the *impedance* of the coil. It is evident that the impedance of a coil to a sinusoidal current depends on three factors; namely, the ohmic resistance of the coil, the inductance of the coil, and the frequency of the current. As we increase each or all of these factors, the impedance increases, although by no means proportionately.

91. If we consider the preceding example with regard to plane vectors, the effective impressed E. M. F. E may be marked off as a horizontal line (Fig. 55), of 50 units in length, The effective current is then expressed as $8/\overline{37^\circ}$ amperes, as shown at I. The effective C. E. M. F. $l \frac{di}{dt}_{eff}$ is of 30.09 units length, 90° ahead of I, in phase. Its angle will, therefore, be $-37 + 90 = +53$; or $f_{eff} = 30.09 /\overline{53^\circ}$. Expressing this as an E. M. F. $f_{eff} = -30.09 /\overline{53^\circ}$ or $30.09 /\overline{127^\circ}$. The total E. M. F. acting on the coil will therefore be $50 /\overline{0^\circ} + 30.09 /\overline{127^\circ}$, and this sum (¶ 70) is e (Fig. 56) approximately 40 units in length, and 37° behind E, in phase; or, $e = 40 /\overline{37}$.

By Ohm's law the effective current strength $i = \frac{e}{r} = 8/\overline{37^\circ}$ amperes.

If we examine the E. M. F. triangle of Fig. 56 we see that the impressed E. M. F. E is resolved into two components, e and f. Of these e is exerted in sending the current i through the resistance r, or is exerted in overcoming the apparent C. E. M. F. of resistance $-ir$ volts; while f, is exerted in overcoming the apparent C. E. M. F. of inductance $-f = -l \frac{di}{dt}$.

The current i, in a sinusoidal current circuit, therefore assumes such a phase and amplitude that the E. M. F. ir, added geometrically to the E. M. F. of self-induction $-l \frac{di}{dt}$ is equal to the impressed E. M. F. E.

DIGEST OF CURRENT TECHNICAL ELECTRICAL ARTICLES COMPILED FROM FOREIGN AND AMERICAN JOURNALS

BY

CARL HERING

DYNAMOS, MOTORS AND TRANSFORMERS.

Armature Reaction and the Theories of Commutation. HAWKINS. Lond. *Elec.*, April 30.—The beginning of an article in which he gives a detailed discussion of the nature of armature reaction; diagrams are given showing the undistorted field and then the field distorted by a wire carrying a current, illustrating how this distorted field acts on the wires. It may be assumed that there are two superimposed fields, that due to the field magnets, and that due to the current in the armature wire; there exists, however, only one active field obtained by compounding the two; these resultant lines are curved near the moving wire, being bunched immediately in front of it and less dense immediately behind it; a wire not only cuts the lines of the magnet field producing the impressed E. M. F., but is also cut by its own collapsing lines giving the E. M. F. of self-induction; this applies to the wire when leaving the field; when entering it it not only cuts the external field, but is also cut by its own expanding lines, which causes a back E. M. F.; thus the displaced resultant field resembles a bent spring, restoring as much energy as has been expended in bending it; it is only the distribution of the field and not the total number of lines which is affected, the field being weakened as much in the rear of the wire as it is strengthened in front of it; the decrease in voltage at the entry of the wire into the field is exactly balanced by the increase at the exit, so that the average E. M. F. remains unchanged; a single wire carrying a steady current, therefore, never cuts its own lines or is cut by them; in the case of self-excitation one portion of a circuit can cut the lines due to another portion of the same circuit; the functions of the two parts of the circuit are in no way combined in the same portion of the circuit.

Theory of the Double Field Machines for Three-Wire Systems. ROTHERT. *Elek. Zeit.*, April 22.—The first half of a long article; in the present portion he reviews briefly the various systems which have been proposed, including that of Dettmar (which has been fully described in these pages) and discusses the conditions; one of the chief elements is the armature reaction; in the Dettmar system there are four poles, so connected that two adjacent ones are north and the other two south, the neutral brush being between two of the like poles; an essential feature is that two of the adjacent magnetic field coils, but of opposite polarity, are connected in series with one rheostat; the two other coils are likewise connected, thus enabling the two circuits to be regulated independently.

Armature Reaction in Unipolar Alternators. KANDO. *L'Elec.* April 24 and May 1.—A long abstract in French of the article which was noticed in the *Digest*, Jan. 2.

Formulas for Transformers.—Lond. *Elec.* April 30.—A brief criticism of Isaachsen of the recent formulas of Russell (see *Digest*, April 10, see also 17 and May 1), claiming that a certain formula is only approximate; it is followed by a reply by Russell, admitting that it is not strictly correct.

Practical Transformer Calculation. DOMMERQUE. *Elec. Eng.* May 1.—An article describing a method of calculation; he deals chiefly with the method, considering details such as the thickness of the insulating material, the covering of the wire, etc., as matters of secondary consideration; the formulas are comparatively simple and are illustrated with numerical examples; the article includes a reprint of some tables by Loppe and Bouquet, giving the values of certain quantities depending on the maximum of induction and the frequency.

LIGHTS AND LIGHTING.

Arc Lighting in America and Europe. WILER. *West. Elec.* May 8, and *Elec. Jour.*, May 1, with illustrations: begun in *Elec. Eng.* May 5, with some of the illustrations, and abstracted in the *Elec. Rev.* May 5 without illustrations.—A reprint of a Chicago electrical association paper describing the prevailing practice in the arc lights and systems in the two countries; much of the matter concerning European practice has already been noticed in *Digest*. The construction of 100-light dynamos and of direct driven arc dynamos has been an important improvement in the American series system; the series system predominates in America and the constant potential was developed in Europe, but it is now in extensive use here; the plant in Munich, in which 640 volts, with twelve lamps in series is used, is briefly described; it appears that the all-night and the evening lights are connected on different sides of the neutral, and the latter may be disconnected by an automatic cut-out, the three-wire system being a two-wire system after midnight. Alternating arc lighting has been in the background both here and abroad; in America these lights are connected with individual transformers; alternating arcs are also in use on the continent of Europe, although only on the constant potential system, no series system having come into extensive use, as the lamps are not yet satisfactory; in England, however, the alternating current has been rectified and is then used with the lamps in series. The gravity feed in the lamps is in use everywhere, but the mechanical means differ greatly from each other; the clutch and rod are the American standard, the clutch and brake wheel the English, and the rack and chain or ribbon in connection with a train of wheels is the standard on the Continent; the American lamps are simpler than the foreign, which latter are mostly focusing; the English lamps are simple, but the Continental contain much clockwork; in England the regulation is mostly mechanical and differential, while in Germany, as in many other countries, the shunt magnet has displaced the differential type to a great degree; double carbon lamps are seldom used; covered carbons are used extensively here and abroad, while coppered carbons are unknown abroad and are used less here than heretofore; the enclosed lamp which has now become the standard, is described; abroad opal globes are largely used, although the holophane globe is coming into use. Abroad arc lighting is used less by far than here, and the conditions of the two countries are quite different.

Comparison of Different Lights. JACOBUS. *Jour. Frank Inst.* May; a reprint of a recent lecture; an abstract is published in the *Prog. Age*, April 1, and a reprint of the complete paper is begun in the issue of May 1.—The lecture refers chiefly to the advantages of acetylene over the electric, incandescent and the Welsbach lights and includes a number of references to the electric light. He showed the appearances of various colors in the different lights, many of them appearing a different shade; the ordinary gas, the incandescent electric light and the acetylene light produce more life-like tints of the hand than the Welsbach; a table gives the candle-power per cubic foot, the energy transformed into light, the heating, and the contamination of the atmosphere, for all four kinds of light; the percentage of the heat converted into light is 0.6 for the flat flame burner, 1.9 for the Welsbach, 2.7 for acetylene and 6.2 for the incandescent electric light. The safety of acetylene is discussed; the relative costs for equal illumination in New York city are given in a table for 16 cp per hour; for the incandescent electric light it is 1.0 cent, for the ordinary burner, at $1.25 per thousand, 0.5 cents; the Welsbach, 0.17 cents; calcium carbide, at $40 per ton, 0.5 cents; the price of calcium carbide for domestic light, to be as ecomomical as kerosene at 18 cents per gallon, is $45 per ton or 6 5 cents per pound of liquid acetylene. It was at one time proposed to convert electric lighting plants into those for the production of acetylene, but this cannot be done economically, as only about one-half as much light would be obtained from the acetylene as from the electricity directly (a fallacious argument, as the current would be used during the daytime); to be as cheap as electricity the carbide must be made where the power and attendance cost much less than at the usual lighting station; the incandescent electric light has held its own at a high cost, which is a proof that other elements enter into the problem as strongly as the cost; each system of lighting has its own field on account of properties peculiar to itself.

POWER.

Power Transmission by Three-Phase and Continuous Currents. ADDENBROOKE. Lond. *Elec. Rev.* April 30.—A general discussion of the relative merits of the two systems. Recent progress has changed the groundwork of the dispute; he discusses the limitations of each system; machines for three-phase currents are available, while those for high voltage continuous currents are not; continuous current machines can safely be built up to 200 kw at 3,000 volts, but the system fails for moderate sized or small motors down to 5 to 8 kw; this is an important point in many installations; there is not much to choose in the first cost, in the efficiency or convenience in working, nor will there be great differences for some time between these.

Electric Power for Agricultural Machinery.—Elek. Zeit. April 22.—An editorial calling attention to the very profitable field in the use of electric power for driving agricultural machinery, especially as the agriculturists themselves are the ones who desire to see this development; the German Society of Agriculturists has therefore offered prizes to the amount of $1,250 for electric and other power plows; tests are to be made this year in connection with an exhibition in Hamburg, but the plows are not to be exhib-

ited until the year after in Dresden; the test will be made in September; there will be two electric and two steam plows competing in the test; the conditions are briefly given.

Electric Driving of Looms—L'Elec. April 10.—A short article referring to some experiments of Siemens and Halske, showing the large amount of lost energy in driving these machines by belts and the great saving if an electric motor is used; with belts the loss in transmission was 38 per cent. and the loss to a certain manufacturer was 28,500 hp hours per year.

Tivoli-Rome Power Transmission.—Lond. *Elec. Eng.* April 30.—A brief description of this alternating current plant, a portion of the power of which is used for railways by being first stored in accumulators; 40 cars are in use.

Mining Installation. Gardner. *Elec. Eng.* May 5.—An illustrated description of the plant of the New York and Scranton Coal Company, at Peckville, where electric power is used for pumping and hauling, the latter by means of a trolley locomotive; it is followed by an extract from a paper by Platt giving the working costs and showing a saving.

Electric Power from High Water Heads. Bennett. *Cassier's Mag.* May.—A profusely illustrated article describing some of the features and experiences with some plants in California in which there is a high head; most, if not all, the installation have been described before.

Electrical Steering Machinery.—West. Elec. May 8.—A very short abstract of the description of the Essberger apparatus, which was noticed in the *Digest* Feb. 20.

TRACTION.

Combined Trolley and Accumulator System in Hanover.—Elek. Zeit. April 22.—An extract from the official report concerning the operation of these lines (on which accumulators are used where the overhead line is forbidden and are charged while the overhead line is used). The results for the year 1896 are very satisfactory in every way; the experiences show the advantages of such a system and have enabled the small defects to be remedied; the cost of maintenance has been accurately determined; the average per car and per month being $10, or 0.14 cents per car km of the mixed system; this cost will be somewhat greater when renewals become more frequent, but will never exceed $15 per car per month; this includes renewals of the plates and therefore keeps the batteries continually in good condition; according to the experience obtained, the amortisation is 6 per cent.; an accumulator car travels 50,000 to 55,000 km per year, so that the cost by which the accumulator system exceeds the other system is 0.5 cents per km run, but considering that 26.5 km of overhead line construction in the city has been saved, not to mention the cost of the underground system, this corresponds to a saving in first cost of $140,000; furthermore, the maintenance of the overhead lines would have been 0.075 to 0.125 cents per car km; there is therefore no doubt that even with the greater cost of the mixed system over the simple overhead system, the excess per km run will not be more than 0.25 cents and the conduit system would have cost at least 1.25 to 1.75 cents more. The results are therefore very satisfactory, and during the coming summer the accumulator system will be introduced on all the other lines; on one of these the simple accumulator system will be used without any overhead lines, the charging taking place in 20 minutes at one of the stations; the distance is 10 miles; there are now in use 29 motor cars for the overhead line and 63 for the mixed overhead and accumulator system, while 110 cars are at present under construction. On the suburban lines it is proposed to have freight trains of four cars which will be drawn by a locomotive provided with accumulators. In the first six months the cost of generating a kw hour was 1.39 cents, and during the second half of the year, when the accumulators were largely in use, the cost was only 1.226, and still less in November and December.

Electric Traction on Canals.—L'Elec., April 24.—Some extracts from a recent report by de Lamarcadie on the trial installations on the Bourgogne Canal, where electricity has been tried for over a year; the results have been so satisfactory that a large installation of this kind is at present under consideration, intended for simultaneously propelling 60 boats over a length of 242 km; hydraulic power will be produced at 30 installations placed at the principal locks. There are two systems, that of propelling a boat by means of a rudder propeller, and by drawing it by means of some traction device on the tow-path, consisting of a three wheel vehicle or locomotive, the two hind wheels of which are driven by an electric motor; it weighs two tons and can draw one or more boats; the results are briefly given in the form of weights and speeds. Experiments showed that the efficiency was better for the latter system than for the propeller; it can be used for drawing a number of boats at a time; it involves the inconvenience of an attendant; the propeller method does not deteriorate the tow-path and does not require the dropping of the tow line when two boats pass each other. For a boat drawing about two meters of water, 2,100 to 2,400 watt hours suffice for a boat of 200 tons at a speed of 2,700 to 2,800 meters per hour; for a double tonnage on two boats 4,000 watt hours are required for the same speed; for a speed of 2,500 meters per hour the energy required may therefore be taken as one kw hour per 100 tons; at eight cents per kw hour the cost of a ton km would therefore be 0.0032 cents.

Mechanical Propulsion on Canals. Robinson. Lond. *Elec. Eng.*, April 30.—A brief abstract from a recent paper, describing experiments on the Bourgogne Canal in France (the author is evidently not versed in electrical terms, and some of the information is therefore not clear). Hauling by means of a chain has recently been started and has given complete satisfaction; experiments with electric traction in various ways were begun there as early as 1888; accumulators have been used in parallel, but it is now claimed that they can be dispensed with; two trolleys are carried by a boat in one of the systems tried; the system used seems to be one in which an anchored chain passes over a drum on the boat, operated by the motor; the saving in operating cost seems to be 30 per cent. as compared with the old method in which steam tugs were used.

Canal Traction.—Lond. *Elec.*, April 30.—States that Sir Leader Williams, an eminent authority on propulsion in canals, is in favor of electrical propulsion; the note further states that the power usually available at the locks would answer only for very sparse traffic and would be quite inadequate for busy canals.

Canal Traction.—Lond. *Elec. Eng.*, April 30.—An editorial calling attention to the effects of the cross-section of the boat and of the canal, as also its depth, in the experimental determination of the power required; unless these are the same a comparison of results on two different canals is of very little value.

Recent Development in Railway Appliances. Baylor. Lond. *Elec.* and *Elec. Eng.*, April 30.—An abstract of a rather long discussion of his paper (See *Digest*, May 8); the discussion appears to be chiefly of local interest and to contain little of general importance. Preece mentioned that the iron lining of the tunnel of the City and South London underground line had been used as a return, but it did not approach being a good conductor, and the result was considerable leakage, doing damage in neighboring cables. Grove spoke in favor of the three-wire system as distinguished from the alternating current system with rotary transformers for long circuits; Parshall replied to this, showing that the three-wire system could not be compared commercially with the multiphase system; the unbalancing becomes cumulative; at St. Louis machines and feeders had to be thrown from one side to the other to correspond to the changing conditions; the loss in the neutral conductor becomes quite considerable; the first cost of a three-wire system for the proposed Central Underground Railway in London would therefore not compare favorably with the multiphase system using rotary transformers; machines of this kind up to 600 kw are running very satisfactorily at Niagara; even in the three-wire system substations were necessary. Geipel thought that for small light cars at slow speeds a single motor might be sufficient; 250 out of the 300 cars used in Hamburg had only one motor, and the power was only 800 watt hours per car mile.

Generation of Electrical Energy for Railways. Raworth. Lond. *Elec. and Elec. Eng.* April 30.—A reprint of an Institution paper, the principal object of which is to show that a suitable and paying price for the energy for railway purposes under reasonably favorable conditions is 2 cents per kw hour; it is chiefly of interest to steam engineers; his conclusion appears to be to use one engine large enough to do the whole work; he applies it to the case of a comparatively small power house. He also discusses the effect of a railway load on the load factor of a lighting station, pointing out the savings, which, though considerable, are little in comparison with some of the expectations.

Walker System of Traction. Eck. Lond. *Elec.*, April 30, *Elec. Rev.*, April 23, and *Elec. Eng.*, April 23.—A reprint of an illustrated paper describing the system used by the Walker Company (Cleveland, Ohio), the details of which have already appeared in the American press.

Brussels.—Lond. *Elec. Eng.*, April 30.—A brief description of the railway system.

Electric Traction Under Steam Railway Conditions. Davis. *Eng. Mag.* May.—An article of a general nature in which he discusses the general principles and their limitations; it is to be followed by a second article in the next issue, in which the comparisons will be made in detail. He believes that during the next ten years there will be a large increase in the substitution of electricity for steam on railroads; he shows where this substitution might be advisable and where it would be a mistake; for light and frequent traffic over short distances the use of electricity will result in a lower first cost and operating expenses, but steam is more profitable when the units are few, heavy and infrequent and distances long (he appears to advance no new arguments); he discusses chiefly the suburban traffic; within twenty miles of the centre of population, electric traction is always worth considering; actual costs and expenses are not discussed; the importance of the item of fixed charges is shown by some figures; the first cost of the electric roads will almost always exceed the first cost of steam roads, but when the gross receipts are sufficiently increased the greater outlay is justified; some statistics for the steam roads in New England are given and are compared with statistics for electric roads, which latter, however, are somewhat incomplete; these figures show the enormous number of passengers per mile, the large receipts per mile of road and per car mile and the greater total number carried on electric roads; the steam roads gave greater receipts per trip; the conditions under which electric traction can be profitably used are enumerated; as an illustration of a case in which electricity might probably be substituted with profit, he takes the suburban traffic of the Pennsylvania Railroad from Philadelphia;

in this he suggests that the electric cars be run through the streets instead of going merely to the terminal station; it involves the laying of additional tracks. In conclusion he states that electric traction in connection with existing tracks and equipment, and under existing operating methods, will result in heavy loss and abandonment of the change.

Safety Device for Trolley Circuits. ROWAND. *Jour. Frank. Inst.*, May.—A reprint of a recent paper accompanied by diagrams showing the connections; he describes a safety device for any circuits, but more particularly for trolley circuits, to act as a protection against the danger arising from an accidental breaking of an overhead wire; his apparatus opens the circuit at the instant the wire breaks or becomes short circuited; it consists essentially of a magnet wound with two circuits and operating a circuit breaker; ordinarily the two circuits balance each other, but when a wire is broken the balance is disturbed and the magnet acts; the device requires the use of an extra small wire which is run to the distant end of the trolley wire to be protected, the apparatus itself being at one end; the apparatus was exhibited in action; several different forms for different conditions are shown.

Trolley Pole Protective Device. SONNEBERG. *St. Ry. Jour.*, May.—A brief illustrated description of a device to protect the trolley pole or the support of the wire, in case the trolley leaves the wire; it consists essentially of a magnet connected in shunt to the car, and which, as soon as the current is broken, operates a switch which causes the motor to generate a current and thereby bring the car to rest rapidly; one of the motors generates a current, while the other is a motor; this magnet is directly connected between the trolley pole and the ground, and is therefore independent of the current which may be broken by the controller; it requires but one-tenth of an ampere.

New Orleans.—St. Ry. Jour., May.—A long, well-illustrated description of the Canal and Claiborne railway; it is of recent construction and involves a number of novel features in track and foundation construction owing to the marshy soil; also a number of divergencies from the ordinary practice in the power station equipment.

Financial Results of Cable and Electric Railways.—St. Ry. Jour., May.—A continuation of the serial; the present installment deals with the suburban and interurban traffic in Massachusetts and includes tabulary information for each of the systems.

Power Station Controversy in Chicago.—St. Ry. Jour., May.—A criticism and a reply to it, based on a recent report; it refers chiefly to the generation of the power.

Electric Railways in Argentina.—West. Elec., April 24.—A reprint of the short article from a foreign paper.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Charging for Current and the Competition of Private Installations. KALLMANN. *Elek. Zeit.*, April 22.—A reprint of a long paper in which he discusses, first, and at considerable length, the various methods of charging, illustrating it with numerous diagrams, comparing the rates for light and power in a number of the German stations; he discusses the principal elements entering into the choice of a suitable rebate system, showing that a time charge would be the most favorable one to the central station. He then discusses the effect on central stations of individual plants of the larger consumers; he shows by means of data and the Zickler curve (a hyperbola) the relative cost of taking current from the station or generating it in a private plant; for large numbers of lights, the latter is of course the cheaper, partly also because gas engines may be used; the Zickler curve, or a curve of equal costs, gives the relation between the number of lamps and the number of hours per year during which they are lit, for equal costs for private installations and for taking the current from the central station; he shows that such private plants are serious competitors. The central stations in Berlin have lately suggested a mean between direct connection and a private plant in the form of an individual storage battery which is to be charged at certain fixed hours from the central station; the battery for such installation is to be furnished and maintained either by the consumer or by the central station, according to agreement; its capacity should be equal to that of the greatest demand, that is, for a day in December. It is to be charged during the hours of light load from the central station; the private plant is to obtain its current only from the battery; this will furnish the central station with the much-desired uniform day-load; the batteries will also act as a very desirable equalizer of the voltage in the net-work of wires; under these conditions the charging current can be furnished at an exceptionally low price; the price in Berlin is to be 4.0 cents per kw hour, the regular price for lights being 14.2 cents. This method enables a central station to offer the current to the private consumers at such a low price that it will compete favorable with the costs of production in an individual plant; allowing 15 per cent. for interest and amortisation and maintenance of battery, the current at the above price corresponds to 7.5 cents per kw hour for the discharge current, depending on the size of the installation and the number of hours during which the lights are run, which is a saving of over 30 per cent., and is probably as economical, but in any case much more reliable and convenient than an individual plant.

Blackburn.—Lond. *Elec. Eng.*, April 30.—A long, profusely illustrated description of the recent extensions of this plant; the direct system has been in use, but in order to reach the outlying districts alternators have been installed in connection with a motor alternator of 20 kw, taking current from the direct current bus bars and transforming it into high tension alternating current for supplying the light load; the alternators are therefore used for only six hours a day in the winter, the motor alternator being used for the outlying districts at all other times.

Electrical Equipment of the "Bugeaud."—Lond. *Elec.*, April 30.—A short description from *L'Elec.*, March 20, of the insulation on this French steamer and pointing out some serious defects.

Storage Battery and Engineering Practice. APPLETON. *Elec. Eng.*, May 5.—A continuation of his serial. He gives illustrations of an automatic underload and an overload switch, and illustrated descriptions of the switchboard and connections for a private plant with end-cell regulation, which is more economical than the counter-cell method when there is an engineer in constant attendance; the operating cost of a private residence plant is given, showing the cost per lamp hour to be 0.8 cent.

Edison Station in New York.—Power, May.—An illustrated description of the coal and ash-conveying machinery at the Twelfth Street station.

WIRES, WIRING AND CONDUITS.

Feeder Conduit Construction. HILL. *St. Ry. Jour.*, May.—A reprint of the portion of his report (see *Digest*, Jan. 23 and Feb. 6) for the city of Baltimore, referring to the different styles of conduits and their ventilation.

Prevention of Fires Due to Leaks. BATHHURST. *Eng. Mag.*, May.—An abstract of the paper noticed in the *Digest*, March 27.

ELECTRO-PHYSICS AND MAGNETISM.

Production of X-Rays of Different Penetrative Values. SWINTON. Lond. *Elec.*, April 30.—A reprint of a short Royal Society paper; he shows that the penetrative power of the X-rays in any given tube is dependent upon the following conditions: It is higher for a high than for a low vacuum; or when the electrical power applied is greater than when it is small; or when the resistance of the tube is greater than when reduced by magnetic means; or when the difference between the cathode and the anti-cathode is small than when it is great; or when the cathode itself is small than when it is large; or when as a consequence of one or more of the above the potential difference between the cathode and the anode portion of the tube and consequently the electrical excitation of the cathode is great than when it is small. On the assumption that the cathode rays are streams of negatively charged molecules whose initial velocity depends on the degree of excitation, the above conditions are those which would conduce to a high average velocity of the molecules at the moment at which they strike the anti-cathode, and at the same time to a high average difference of potential between the traveling molecules and the anti-cathode; at high exhaustions the excitation and initial velocity are greater and the average velocity and the amount of negative charge of the molecules have suffered less diminution; for greater electrical power the excitation and initial velocity is increased; a magnetic field reduces the resistance and the excitation; nearness of the anti-cathode decreases the loss of charge; with a small cathode the traveling molecules are more compactly arranged and therefore do not lose so much in velocity or charge; whatever therefore is the precise cause, the penetrative value is dependent on the average velocity and the voltage between them and the anti-cathode at the moment of impact, being higher the higher the velocity and the greater the voltage; this hypothesis will also account for the X-rays being heterogeneous under all conditions; the penetrative value as distinguished from the quantity of X-rays is furthermore independent of the material of the anti-cathode; the quantity of rays was greater with the platinum; metals of high atomic weight form the most efficient anti-cathode in quantities of rays generated.

Testing Paintings by Röntgen Rays.—Lond. *Elec. Rev.* April 30.—A note stating that a valuable painting in Munich was recently tested by means of X-rays, as it was doubtful who the artist was; the photograph showed the correct lights and shadows, and revealed the initials of the artist, as also his monogram with the date. It is thought that this method might be used to detect fraudulent imitations of valuable paintings.

Discharge of Conductors with Variable Capacity, Resistance and Self-Induction. PETROVITCH. Lond. *Elec. Rev.*, April 30.—A brief abstract of the article noticed in the *Digest*, April 17, including the deduction of the formula.

Dielectric Constant of Liquid Oxygen and Air. FLEMING and DEWAR. Lond *Elec. Rev.*, April 30.—A reprint of the Royal Society paper noticed in the *Digest*, April 10.

Feeble Magnetization. HOLBORN. Lond. *Elec.*, April 30; abstracted briefly from the *Berliner Sitzungsberichte*, 8. He determined the magnetization curves of iron and steel in weak fields; Lord Rayleigh showed that these curves are straight lines up to certain limits; the present author showed that the linear character of the curves is preserved for greater ranges than has been supposed.

Time Lag of Magnetization. HOLBORN. Lond. *Elec.*, April 30, abstracted briefly from the *Berliner Sitzungsberichte*, 11, 1896. The question of the existence of a time lag cannot be considered as completely answered; he seems to have proved that after a two-hundredth of a second no further increase of magnetization is discoverable; this confirms Oberbeck's observations with currents of 200 alternations per second.

Hurtful Actions of X-Rays. Tesla. *Elec. Rev.*, May 5.—A very long communication, giving his views on the subject and the results of extended researches. The important points brought out in the paper appear to be as follows: No experimenter need have any fears, provided he does not ignore certain precautions; the hurtful consequences can be completely prevented by a conducting object, such as a sheet of aluminum or wire gauze protecting the object and connected with the ground; the injurious effects seemed to cease abruptly when the distance from the tube was increased; he believes the effects are partly due to ozone, which is produced abundantly and its generation ceases abruptly at a certain distance; the injurious action is electrostatic, or due to electrification or to secondary effects resulting therefrom; the injurious effect practically ceases when a layer of fluid, easily penetrated by the rays, is used to protect the skin from contact with the air; experiments with tubes containing aluminum only and platinum only were made, and it was found that those with platinum were by far the more injurious; the tubes were made of an improved Lenard pattern and the results are described; in one case he felt a sensation of pain deep in the tissues or in the bones, continuing for a few days afterward; the pain felt was instantaneous and the injury was immediate; with a bulb containing no platinum the injury was not nearly so severe; effects similar to a cold were produced on the nasal organs; with a powerful bulb an effect was produced as positive as a touch, and was similar to one produced near a noisy spark gap or in general when the ear is exposed to sharp explosions; he concluded that the rays produced violent explosions and concussions, although inaudible; he then tried the effect of distance and found that the rays acted like a source of intense heat; a hand may be brought to a certain definite distance from a source of intense heat without serious injury, and the bulb acts quite similarly at a certain distance and there is no hurtful effect, no matter how long the exposure; to liken the effects to sunburn is a mistake, as there is no similarity; they are similar to the effects of radiant heat; he thinks all the effects are limited to the surface of the body, the internal tissues being safe unless the tube is very close to the skin; the injury may not all be due to the rays directly, as they are propagated in straight lines while the injurious effect is not always in the direct path of the rays; the screen and plate do not give an idea of the intensity of the rays; in the use of an aluminum protective screen it should not give any spark when touched by the subject, but if it does there should be a condenser in the ground circuit; no serious injury can result if the distance is greater than 16 inches and the proper precautions used. He still believes the action of the bulbs is an emission of a stream of small particles, and he thinks that some of these are forced through the tube. The injurious actions are: First, the thermal effect; the temperatures corresponding to the velocity of the particles may be as high as 100,000° C. Second, the purely electrical effect; the particles convey an immense amount of electricity which he can measure, and these charges will be given off at the skin, producing strong local currents. The third effect is the electro-chemical, including the generation of ozone. The last effect is purely mechanical, due to the mechanical impact of the particles and unavoidable heating. He recommends abandoning tubes containing platinum, to use Lenard tubes containing only pure aluminum, to use a protecting screen of aluminum or a wet cloth or layer of a fluid, and to expose at a distance of at least 14 inches, and preferably more, increasing the time of exposure.

ELECTRO-CHEMISTRY AND BATTERIES.

Alkaline Phosphates and Caustics.—L'Elec., April 10.—A note stating that a new process is in use at Biebrich-on-the-Rhine. The concentrated solutions of phosphoric acid and a double alkaline nitrate, chloride or sulphate of sodium, are separated by a diaphragm; in the anode compartment nitric or sulphuric acid or chlorine are produced, and in the cathode department an ortho-phosphate of sodium; the anode is carbon and the cathode lead; for obtaining alkaline caustic the phosphate of sodium is treated with caustic lime, giving a by-product of phosphate of calcium (the description lacks clearness).

Calcium Carbide.—Lond. *Elec. Rev.*, April 30.—An editorial notice of two recent improvements; the first is by Willson, and appears to consist in using finely pulverized material and an alternating current; the difficulty of feeding is overcome thereby, and the output is said to be nearly double that obtained with the direct current (the authority for this is not given). The second is by Pictet in Geneva; the furnace is provided with tuyeres some distance above the bottom, which form a series of blow-pipes, air being injected through them, the combustion being obtained from an excess of coke; the electric arc is at the bottom; the combustion heats the material to 2000°, the blow-pipes to 2400, while the electric arc raises this to above 3000; the fused material runs out near the bottom, but there is always a layer of calcium carbide at the extreme bottom to protect the lining.

Carbide of Calcium.—Lond. *Elec.*, April 30.—A note stating that it has been suggested to produce large quantities of this material from the huge deposits of peat existing in certain parts of Germany; about 30 tons of peat are calculated to be capable of producing the power for making one ton of carbide.

Electrolytic Treatment of Sulphide Ores. Ashcroft. *Eng. Mag.*, May, abstracted from the *Austrian Mining Standard*, Jan. 20.—This process is claimed to be the first to deal successfully with the electrolytic treatment of sulphide ores on a commercial scale; it is to be used at Cockle Creek, New South Wales, where 5000 tons of ores per week are to be handled; the process is cyclic; the finely ground ore is roasted at a low temperature converting the lead and zinc sulphides into oxides and sulphates, the silicates not being caked; it is then leached with ferric chloride and sodium sulphate; the zinc oxide is dissolved as chloride and the solution of the lead is prevented by the sodium sulphate; when the strength is about 30 grams of zinc per liter the leaching is discontinued; the solution is heated with smal quantities of bleaching powder, changing the ferrous iron into the ferric state and the iron is brought down with zinc oxide; after filtering, the solid matter, rich in silver, goes to the smelting furnace; the silver and traces of other metals are removed by using zinc as a precipitant; the solution is then electrolyzed, depositing a hard, bright, pure zinc with iron anodes, the iron consumed being used in the smelting operations as a flux for the lead; diaphragms are used; the solution finally passes over iron anodes where it takes up chlorine; the solution is exhausted at 12 grams of zinc per liter and is then used over again.

UNITS, MEASUREMENTS AND INSTRUMENTS.

New Method of Determining the Temperature Coefficient. Towe. *Elek. Zeit.*, April 15.—A description of a method which is claimed to be simpler and surer than the Wheatstone bridge method for such a determination; it is for measuring the temperature coefficient of a material in the form of a wire; the wire is wound in the form of a coil and is placed on one side of a magnetometer, its action being compensated by a coil on the other side; if now the first coil is heated, which changes its resistance, there will be a deflection which gives a means of measuring the increased resistance and therefore the temperature coefficient; the values of the deflections are first determined accurately by inserting known resistances in the circuit and thus calibrating the instrument; the results are laid down graphically and form a straight line; the original resistance of the coil must be accurately determined for a known temperature; the coil is heated in an oil bath, the temperature of which is measured very carefully with thermometers; he recommends the use of the Wiedemann mirror galvanometer, on which the coils may be moved by means of a screw thread so that they can be accurately adjusted for the compensation. In conclusion he gives the results of some determinations, of which a large number were made; from these it appears that the accuracy was within 0.1 per cent.; the advantages of this method over the usual Wheatstone bridge method are stated.

Method of Measuring High Frequencies. Besso. *Elek. Zeit.*, April 15.—A short comment on the device of Meyer, which was noticed in the *Digest*, Feb. 20 (see also March 6). It has not yet been proved that the loss of energy by hysteresis remains proportional for a very high frequency, but this apparatus is well adapted to investigate this very question experimentally; the temperature constant should be calculated as for the Cardew voltmeter; an experimental determination could be made by sending a known and constant current through the wire.

Acetate Standard Cell. Mauri. Lond. *Elec.*, April 30.—A brief abstract from an Italian journal. He states that his mercurous acetate cell is much more constant than the Clark cell; the solutions may be slightly acid without interfering with the voltage; it preserves its E. M. F. to within 0.0002 volts and reaches its final value one day after manufacture; this value is 1.3266 at 15 degrees; its temperature coefficient is about one-tenth that of the Clark cell; the Weston cell, he states, fell from 1.0321 to 1.0190 in a little over a year, owing to the mercuric sulphate attacking the cadmium in the amalgam and making it richer in mercury; the zinc acetate used in the author's cell is saturated and the cell "consists of an evaporating basin holding the mercury and containing another which holds the zinc."

Electrical Testing for Telegraph Engineers. Young. Lond. *Elec.*, April 30.—The beginning of a serial which is extracted from a forthcoming work. These extracts will relate mainly to submarine cable work, but will include the theory and much of the practice of overland line testing. Being in the nature of a treatise on the subject, this series will not be noticed again in these columns; the present portion deals with the measurement of insulation resistance.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Problem in Ocean Telegraphy. Bright. Lond. *Elec.*, April 30.—A short article referring to a statement made in a recent article by Houston and Kennelly (see Electrical World, March 27, p. 421) to the effect that if the insulation of a cable could be reduced to about 500 ohms per nautical mile the cable would be distortionless. Although the typical cable for high speed would have a low resistance, the author questions whether this ideal can be safely realized in practice; he refers chiefly to the mechanical qualities and durability, both of which are of equal importance with the electrical qualifications of an insulator; it has long been recognized that comparatively costly substances alone meet the requirements; with these substances the insulation could never be as low as that required, with a safe thickness and with the proper limit to inductive capacity; an insulating material which will meet the conditions has therefore yet to be discovered.

Cable Speeds. Raymond-Barker. Lond. *Elec.*, April 30.—A reply to the notice of his system of measuring cable speeds (see *Digest*, May 1 and 8)

and explaining how easily his formula is applied to the system used by the Eastern Company. A communication to the same effect is also contained in the Lond. *Elec. Rev.*, April 30.

Ocean Depths.—Lond. *Elec. Rev.*, April 30.—A long editorial and unfavorable criticism of a recent article in the *Elec. Eng.*, N. Y., in which doubts were expressed concerning the feasibility of a Pacific cable; the criticism contains data about ocean depths and existing cables.

River Plate Telegraph Dispute.—Lond. *Elec. Rev.*, April 30.—A communicated article describing the recent dispute between the company and the Government.

Telephone Statistics for Austria.—Elec. Zeit., April 22.—A reprint of a large table containing a list of the installations, the number of subscribers, etc., for the end of last year.

Telephone Installation Without a Central Station. PIERARD. *L'Elec.*, April 17.—A brief illustrated description of the same system which was noticed in the *Digest*, March 27, but modified so as to adapt it to induction coils.

MISCELLANEOUS.

Protecting Houses Against Lightning. KOCH. *Elek. Zeit.*, April 22.—A discussion with some interesting suggestions. Findeisen suggested as a very cheap method to connect all the metallic parts on the outside of a house together and to a lightning rod; the question of whether this would protect is discussed; old, rusted iron lightning rods on church towers have been known to be very satisfactory in leading the lightning to earth; according to the usual ideas such a lightning rod should be dangerous rather than of use, as its resistance would be enormously high; its action, however, can be explained on the assumption that during the discharge the resistance is very small; this follows from the researches of Branly with discontinuous conductors under the action of electrical oscillations, showing that they have become conductors; the suggestion of Findeisen therefore appears to be founded on correct principles, as the discontinuous conductors would become good conductors during a discharge; a test was furthermore made with a loosely connected iron conductor in series with a galvanometer and accumulator, and it was found that a neighboring high potential reduced the resistance at once to one ten-thousandth part of that at the start; it was therefore probable that the Findeisen system would be quite satisfactory. He then describes a very cheap system which he has frequently advocated; if points at the top of a building are efficient then why should not points into the ground be equally efficient to replace the usual ground connections, which are often so difficult to make and so expensive?; present forms of lightning rods are supposed to neutralize the charge in the clouds, but he claims that they do not succeed in doing so; the object of a lightning rod is to protect the inside of the building from a discharge, and this can be done by the well-known Faraday cage; it will suffice to run ordinary galvanized iron wires around the top and edges of a house, say in the form of about 10 wires, each leading into the ground; if telephone or other wires or gas or water pipes enter the house they should be connected with this system of lightning wires through suitable arresters when necessary; the platinum or gold points he considers unnecessary. Precht has shown that the issuing of electricity from points takes place so slowly that the points cannot respond to the rapid oscillations of the lightning discharge; the wires may be secured directly to the building; as iron rusts when soldered, all soldered joints should be avoided and the wires should be run in continuous lengths into the ground; the earth connections may be made by simply running short pieces of wires into the earth; the cost of such a system for an ordinary house should not exceed $4 to $5.

Avoiding Collisions at Sea.—L'Elec., April 24.—A note describing a recent suggestion of a Frenchman; it consists in driving a small float in front of the boat and connected thereto by a cable and at a distance about equal to the length of the boat; it should be driven electrically and should contain a bright electric lamp; it must be capable of being steered so as to be always kept in front of the vessel; it is claimed to have been established that if large high-speed vessels see each other at a distance equal to double their length a collision can always be avoided; to meet the case of wrecks this safety device should be provided with a torpedo or similar device which would explode on contact and thereby give notice.

Electric Heating and Cooking. COLIN. *L'Elec.*, April 17 and 24.—A long abstract of the article which was noticed in the *Digest*, April 17.

Epoch-making Events in Electricity. STOCKBRIDGE. *Eng. Mag.*, May.—The second article of this series. It refers to Oersted, and to magnetism and motion from the electric current.

Biographical.—West. Elec., May 8.—A portrait, with a short biography, of G. H. B. Zahn.

Book Reviews.

METHODE DI MISURA DELLE GRANDEZZE ELETTRICHE. Par il Prof. Riccardo Arno. Published by the Unione Tipografico-Editrice, Milan, Italy; 112 pages, 60 illustrations.

This little book was written for use in technical schools and colleges, where a compendium of laboratory and instrumental testing and measuring methods is needed. Covering about the same ground as the electrical chapters of Kohlrausch's "Physical Measurements," it gives very clearly and simply the essentials of each method in vogue and a description of the usual instruments employed in each case. A preliminary chapter gives a description of the Poggendorff, Gauss and Kelvin arrangements for mirror and scale readings with telescope or spot of light.

Under Resistance Measurements, the special cases of galvanometer resistance, very small and very large resistances, indirect methods, resistance of electrolytes, intense resistance of batteries, etc., are treated. Current intensity is treated at length with reference to alternating and instantaneous as well as direct currents. Eight methods of potential difference measurements in general are given, ending in a paragraph on voltmeters, while alternating potential difference and electromotive forces of batteries are treated fully.

Other chapters deal with electrostatic capacity, inductance, phase difference and frequency. The measurement of electrical energy in the cases of direct, alternating, single phase and triphase currents, receives much attention.

The conclusions reached by the International Electrical Congress at Chicago in 1893 relative to electrical units are embodied in an appendix, which contains, also, a number of useful tables.

It is to be regretted that this timely and useful little book is printed in Italian, since it possesses many points of merit which would recommend it were it available for English-speaking students.

AUTO-CARS, CARS, TRAMCARS, AND SMALL CARS. By D. Farman, M. I. E. E. Translated from the French by Lucien Serrallier, with preface by Baron de Zuyler de Nyevelt. 112 illustrations. Whittaker & Co., London; The Macmillan Co., New York, 1896. 249 pages. Price, $1.50.

To engineers desirous of learning what has been accomplished in developing the construction and use of self-propelling vehicles, the whole of this book will certainly be of value.

To the layman the latter part, treating of the subject from an historical and descriptive standpoint, will be of interest.

The first chapter treats, by the aid of higher mathematics and the calculus, of the expansion of gases and the work done by this expansion. Part of this chapter is devoted to the mechanics of traction and car resistance.

The third chapter deals with the theory of the various types of motors employed for this work, these being steam, gas, petroleum and electric.

The next five chapters are devoted to the description of cars propelled by different forms of the above-mentioned motors, and furnish to the non-technical reader the most interesting and valuable portion of the book. Many cuts add interest to this part. The last chapter deals with some of the minor details in connection with this work, such as lubrication, tires, axles, carbureters, ignition and vibration.

The report of the result of the Paris-Marseilles race of September, 1896, and the report of the commission on the cars entered for the Chicago *Times-Herald* race are included.

The book ends with an excellent index.

1897 EDITION OF "STANDARD WIRING." Mr. H. C. Cushing, Jr., the electrical inspector for the Fire Underwriters' Tariff Association of New York, has just gotten out the 1897 edition of the handbook, "Standard Wiring," for electric light and power. This is the fifth edition of 5000 copies, and, like the previous editions, is handsomely bound in a flexible leather cover of convenient size for the pocket. Mr. Cushing has succeeded in making this an authority on the subject with which it treats, and the good effects of its teachings have had much to do with the standardizing of electric light and power installations from the fire underwriters' view.

UNIVERSAL ELECTRICAL DIRECTORY.—We have received from the publishers a copy of the J. A. Berly's Universal Electrical Directory for 1897, which is published by H. Alabaster, Gatehouse & Co., London, England. This work, which is now in its sixteenth year, contains a complete record of all the industries directly and indirectly connected with electricity and magnetism, and the names and addresses of manufacturers in Great Britain, India, the English colonies, America, the Continent, etc., aggregating 22,658. The book is noticeably growing larger from year to year, this last issue containing no less than 1114 pages. The contents of the book are arranged in a manner calculated to facilitate ready reference, and it seems to be in every way very complete.

Improved Gas Engine.

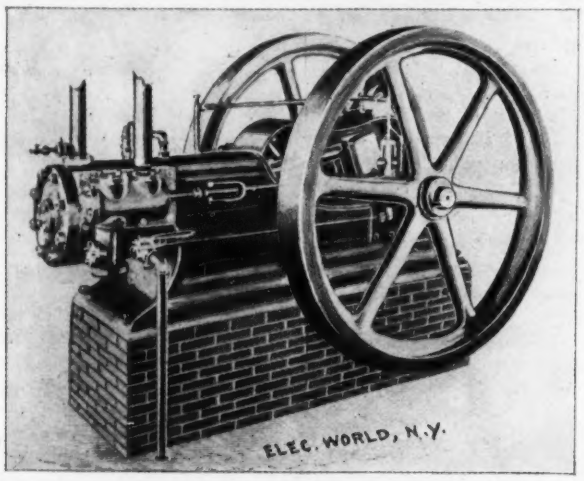
Gas engines are manifestly growing more popular as time rolls on, and enterprising mechanics have given much thought to the problem of bringing this class of engine to the highest degree of perfection. The result of these efforts is that very satisfactory machines can now be procured, and since the demand for them is constantly increasing it is very evident that they have attained a firm hold upon popular favor.

Among the most prominent and successful exploiters in this field is the J. W. Ruger Manufacturing Company, Buffalo, N. Y., which has been in the business since 1856. This concern has applied itself diligently for years to improving its gas engine, and it now presents for the consideration of all interested a type of prime mover that is said to possess real merit. It has

been named "The Fenner," after its designer, Mr. Fenner, a well-known mechanic of ability.

The features of the engine are these: Simplicity in design; not liable to derangement; accessibility of the parts; economical in the use of fuel; positive ignition of charge; close governing; quiet running, and durability. In its construction the engine has a light yet strong appearance, the base and cylinder in the smaller sizes being cast in one piece. This insures a more perfect alignment, and at the same time makes the engine lighter in weight and more attractive in appearance. In the larger sizes of engines the base and cylinder are separate castings. With them a special starting device is supplied, and tube or spark igniters can be had, as desired.

The governing of the engine is accomplished by the direct and positive control of the gas valve by the governor, which graduates the charge to



Gas Engine.

correspond with the load. Therefore, the actual amount of gas consumed is proportionate to the work done.

The engines are automatically oiled and will run for several days without attention. They will run with manufactured gas, natural gas, producer gas or gasoline, and require from 15 to 20 feet of gas per hp hour, according to the strength of the gas.

The "Fenner" engine is adaptable wherever power is used or required, and is especially available for the driving of electric light dynamos on account of its steady action. These engines are made in sizes from 5 to 50 horse-power.

Slow Speed Mult polar Dynamo.

The C & C Electric Company, New York, has put upon the market a new slow speed multipolar dynamo of the direct-connected type, which possesses several points of superior merit. The magnetic frame is made of soft mag-

Direct-Connected Slow-Speed Dynamo.

netic steel of high permeability, and the fields are so designed as to insure proper flux density in the air gap under all conditions of load. The field coils are reinforced with a metal facing to avoid injury in handling and to facilitate removal from the poles. The brush-holder supporting frame is of new design and allows free access to all the brushes. The brush holders themselves are of the C & C reaction type, with sensitive spring pressure on the carbons, allowing free movement of the brushes and securing uniform, medium light pressure. This insures the least possible wear on the brushes.

The armature core is built up of very thin plates, properly insulated and thoroughly ventilated. The plates are made of the best charcoal iron or soft steel stampings, equal in permeability and hysteresis characteristics to any armature core on the market. The conductors are laid in slots in the armature core and are insulated from the same with mica, micanite or some equivalent insulating substance. The commutator is of the best mechanical construction and is rigidly supported on the hub of the armature wheel, making it possible to remove the armature and commutator complete from the shaft and facilitating the assembling of the dynamo at the point of erection. The commutator bars are of the best drawn or rolled copper and are insulated from each other with the best clear mica.

The regulation of this new machine is automatic at all loads, and it is stated that lights are not affected by change of load from no load to full load; neither is it necessary to move either the hand regulator or the brushes.

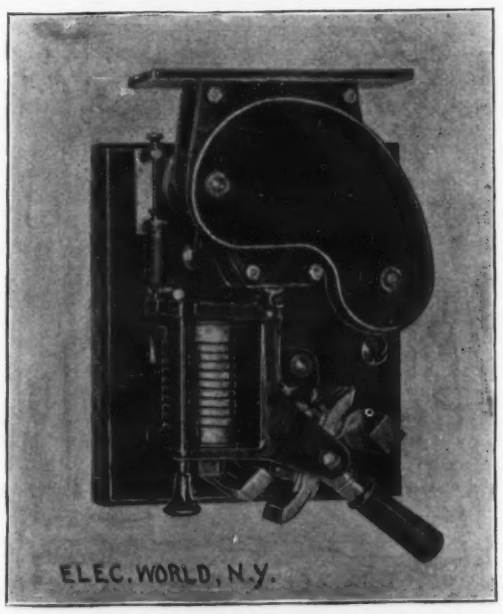
The mechanical construction is said to be the best throughout and all parts are interchangeable. The bearings are self-aligning and self-oiling.

Automatic Circuit Breaker for Small Currents.

The well-known automatic circuit breaker of the General Electric Company, known as form K, for heavy currents is now followed by one for use with smaller currents, *i. e.*, for 100 to 500 amperes. It is known as the form L and, as with the K, may be used on any potential up to 750 volts.

The form L circuit breaker is substantial in construction and compact in form. It is mounted on a slate base, 11 inches by 12 1-2 inches, and the maximum overall measurement from the back of the base is six inches. It can be provided with either front or back connections. Its action is similar to that of the form K circuit breaker used in power stations for heavy currents. The current passes through built-up leaf contacts to the tripping coil, the armature of which actuates the tripping device. An adjustable tension spring holds the armature away until sufficient current flows to overcome its pull, drawing the armature to the magnet coil.

The leaf contacts are held normally against the main contact blocks. When the tripping armature is drawn to its magnet, the main contact is released and the circuit instantly opened by the action of the main spring. To prevent arcing at the main contact, the current is shunted through a



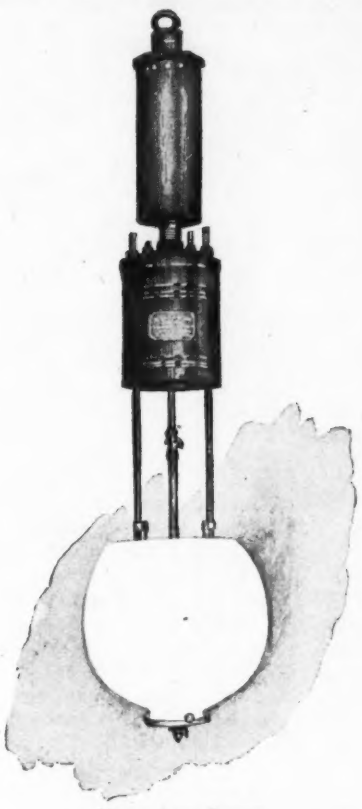
Circuit Breaker.

secondary contact plug protected by the blow-out magnet. This plug is not withdrawn until after the leaf contacts have left the contact blocks, and all tendency to arc, therefore, is confined to this point, where the magnetic action prevents it from doing damage. The blow-out magnet and secondary contact are in series with each other, but are connected in multiple with the main contact. Owing to their high resistance practically no current flows through them until the circuit through the main contact is opened, when they take the whole current, creating the magnetic field and extinguishing the arc independently and apart from the main contact.

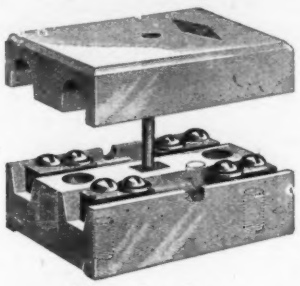
The marked rating of a circuit breaker, as 100-500, indicates the lowest current that will automatically open the circuit and the maximum normal current-carrying capacity. The circuit breaker is set to open at any desired current from its lowest rating to 50 per cent. in excess of its highest rating by adjusting the calibrating spring of the tripping armature. An indicator on the adjusting stud registers with well-spaced marks on a brass scale, showing the current at which the circuit will be opened.

New Style of Cut-Out.

In the accompanying illustration is represented a new style of main-line cut-out made by the Peru Electric Manufacturing Company, Peru, Ind.



NEW ARC LAMP.



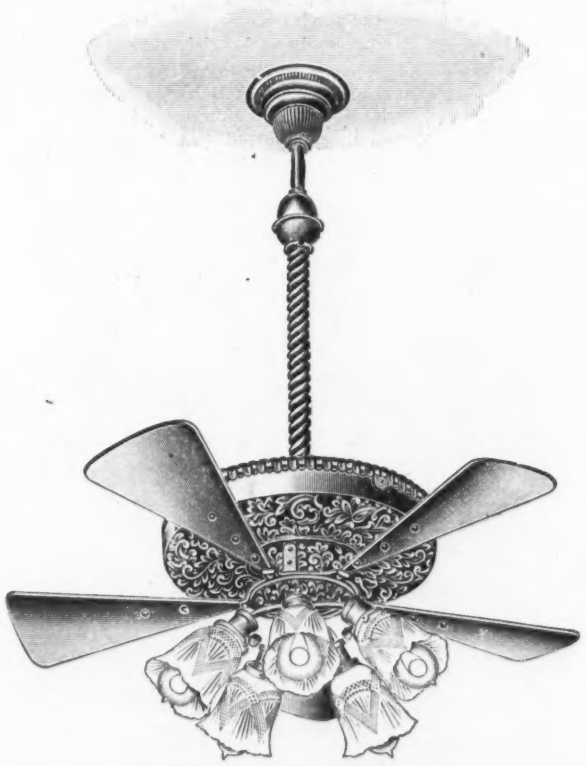
MAIN CUT OUT.

The base and cover of this main are made of the Peru Company's porcelain, which enjoys an excellent reputation in the trade. The terminals are massive and well secured to the base, and the cover is held in place by only one screw at the center of the base. The conductor channels are of ample proportions, to admit of the largest wires.

This main is designed with a view to utilizing it as well for concealed work when desired, and its trade designation is the "S-M Style Main."

A New Low Potential Arc Lamp.

We illustrate herewith a new form of arc lamp manufactured by the Paragon Arc Lamp Company, Boston, Mass., which is intended to be used on low-tension constant potential circuits. The feeding of the lamp is controlled by a clutch connected with a lever which is operated by two magnets arranged on the well-known differential principle. At the end of the lever is an air dash pot, which gives great steadiness in operation. The inner ring of the clutch is made of a very hard metal to ensure durability, and is so designed as to revolve, producing an even wear. On the base of the feeding mechanism is a small brass screw to adjust the pick-up. The lamps are, however, carefully adjusted at the factory, so that further change is unnecessary. They are arranged to be run two in series across a 110-volt circuit. Two sizes are made at present, designed to take 6 1-2 and 10 amperes per pair, respectively. When taking 6 1-2 amperes per pair, each lamp gives 1200 candle-power, and when consuming 10 amperes per pair, 2000 candle-power is obtained. The lamps give a run of 14 hours per trimming. The lamp combines elegance of design with simplicity of construction.



INDUCTION CEILING FAN.

The "Twentieth Century" Ceiling Fan.

The evolution and refinement of the ceiling fan is an interesting study, and in the rapid march of progress these machines are reaching nearer and nearer to the final goal of perfection.

Electric fans have long since ceased to be classed as luxuries, and when they passed from that classification they passed into that known under the general term "necessity." Since they have become a necessity the best is always demanded.

Among the standard ceiling fans now on the market is the "Twentieth Century," made by the Emerson Electric Manufacturing Company, St. Louis, Mo. This machine, which is illustrated on this page, is designed for high-tension alternating systems, and is said to consume only 100 watts of energy. It runs at a speed of 500 to 600 revolutions per minute, the 30-inch blades being made of aluminum to secure lightness. The fan is said to be of high efficiency, and its quiet running is one of its most excellent features.

Fixtures with two, three, four or five incandescent lamps may be had where light is desired in connection with the fan, and the two functions in one machine will no doubt meet with hearty appreciation.

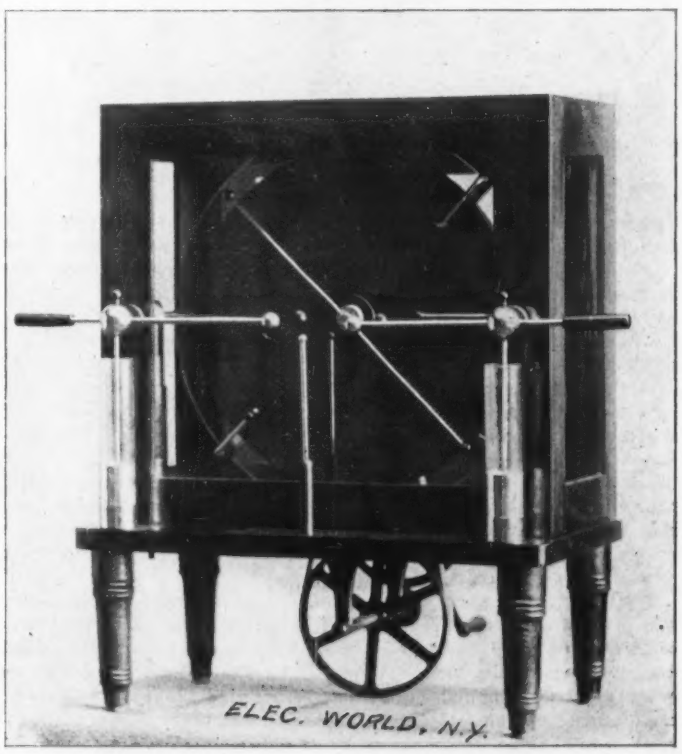
The fans are finished in nickel, brass and oxidized copper. They have a very attractive appearance, and will surely meet with a ready market where high alternating currents are used.

A New Röntgen Ray Outfit.

The Swett & Lewis Company, successor to G. A. Frei & Co., Boston, Mass., furnishes a very efficient X-ray outfit, consisting of a static machine, a focus tube and a fluoroscope. We illustrate herewith the static machine, which has recently been improved in many respects. It has four plates, two of glass and two of rubber. The latter are mounted on ball bearings and can be driven by hand at a speed of 1800 revolutions per minute. The device is enclosed in a very neat and substantial moisture-proof mahogany case, having glass sides to permit a thorough inspection.

The company also builds another style, similar in design to the above, but arranged to be driven by a motor located in the base.

The X-ray tubes manufactured by the Swett & Lewis Company are especially made of imported glass, entirely free from lead or other impurities, and give a very fine definition. One notable type of very high power has recently been designed for the company by a well-known Boston physician, and is intended for use on eight-plate Wimshurst machines and induction coils. It has met with unqualified success among the hospitals and medical fraternity.



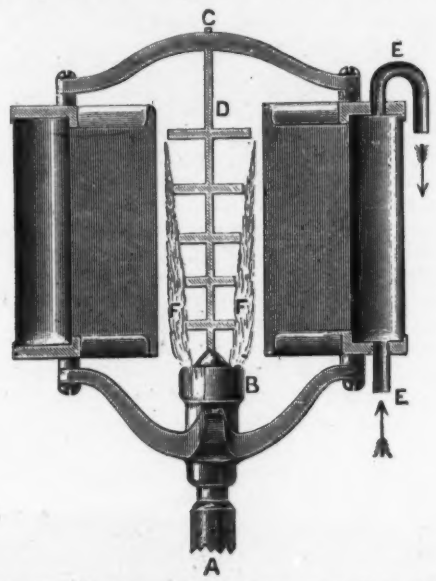
STATIC MACHINE FOR RÖNTGEN RAY WORK.

The latest novelty is an adjustable spark gap. It is easily fitted to any style of static machine and improves the definition very materially.

A Thermoelectric Generator.

In view of the many attempts to discover some new method of producing the electric current direct from heat it is interesting to know that there is to-day on the market a commercial machine for accomplishing this result. This apparatus, the invention of Mr. H. B. Cox, employs the well-known principle of thermoelectric current generation due to the heating of one union of two dissimilar metals and the cooling of the other. The Cox thermopile, or thermoelectric generator, is, however, not brought forward as a revolutionizing invention. It simply produces electric currents continuously on a small scale by means of a practical non-deteriorating piece of mechanism, requiring very little attention, and is simple in operation. It is made by the Cox Thermo-Electric Company, Ltd., London, England. At the present time it is built in one size only, and when completed takes the form of a short cylinder, which is supported by a suitable bracket holding a Bunsen gas burner. The active thermoelectric element is entirely sealed in a cement casing.

The elements consist of short pieces of Seebeck's alloy, composed of two parts antimony and one part zinc, the outside ends of which are joined together by means of copper connecting strips forming the other element of the thermoelectric couple. These elements are joined to form a star shape, five of which are included in each generator. The joint between the copper and antimony alloy is made by a peculiar casting process, which makes a gradually shaded junction between the metals. Each complete combination of star-shaped thermoelectric elements is practically cast at one operation, forming really a compound metal casting. The different castings are connected together in series, one being placed on top of the other, separated by means of cement insulation, and the entire battery is



Sectional View of Thermoelectric Generator.

then surrounded by cement formed in the shape of a short cylinder with a central opening. The peculiar joint between the thermoelectric elements is almost free from disintegration, owing to the sealing of these elements in a cement casing, which practically prevents oxidation and injury from any source.

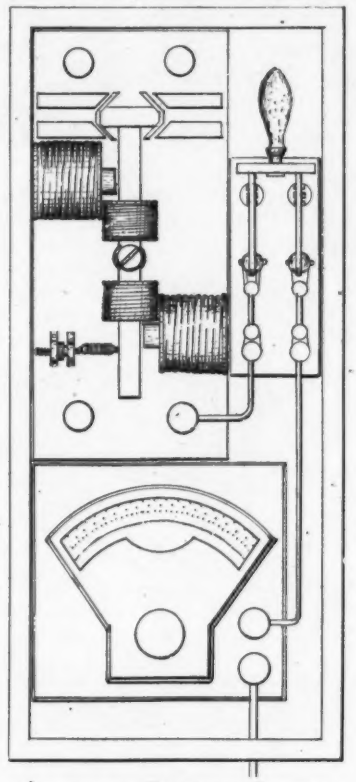
After the active elements have been placed in the cement casing, a band of copper is placed around the outer circumference. The entire encased active element, so called, is then set in a disc-shaped base and surrounded by a sheet of tin or iron, leaving a space between the copper band around the cement cylinder and the interior of the outer casing. Through this annular space water is circulated. The complete device is fitted to a bracket having a Bunsen gas burner projecting into the central opening in the cement cylinder. From the top of the cylinder a deflector is hung so that the flame is suitably spread. Water in the outer chamber not only covers the outer junction of the thermoelectric couples, but also prevents deterioration due to excessive heating.

The manufacture of this new thermopile is exceedingly simple and every step in the process is carefully tested to detect flaws. A varying number of these star-shaped castings are used in the complete generator, depending on the work to be done. A volt can be obtained from as low as seven couples of antimony and copper, but in practice about 10 to 12 are used. Each casting contains about 15 couples, and at present five castings are used in the standard generator. Such a generator develops five volts on open circuit and five amperes when closed through an ammeter. It is stated that this result is obtained from 2 1-2 cubic feet of ordinary gas, which is about one-third of the quantity used by the ordinary gas burner. On this consumption the generator will run a six to eight-inch fan motor continuously.

It is to be noted that this generator produces a current without fluctuation, and is, therefore, particularly available where a current of this class is needed. The internal resistance of the generator is about .6 of an ohm when in operation.

A New Railway Car Lighting System.

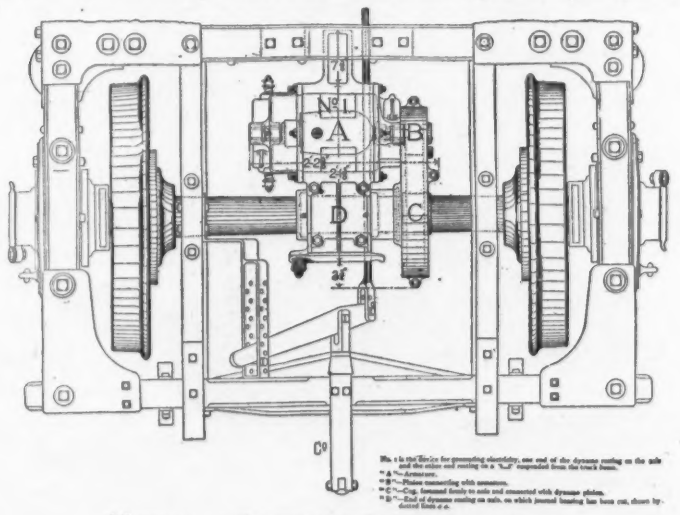
A very interesting and successful demonstration of a new electric car lighting system was made on May 6 by the American Railway Electric Light Company, New York City. A Pullman parlor car equipped with the system was attached to an ordinary local train and run from Jersey City to New Brunswick and return, over the Pennsylvania Railroad, making the regular stops. This car is lighted by some 28 16-cp incandescent lamps. Current for these lamps is initially furnished by means of a small dynamo placed on one of the car trucks and suitably geared to one of the axles. This dynamo



Automatic Charging Switch.

charges a set of storage batteries, and by means of peculiar controlling devices the batteries are charged at a constant current by the dynamo after a certain speed has been attained.

The dynamo, which is completely enclosed in an ironclad casing, is suspended from the car axle, which is not in any way altered or changed. A split sleeve is clamped around the centre of the axle by means of two clamp rings, one at each end of the sleeve. On this sleeve the dynamo is pivoted on one side, while the other is supported by means of a spring. A gear wheel is bolted to the split sleeve and meshes into a pinion on the dynamo



Method of Connecting Dynamos to Axle.

shaft. This gearing is entirely enclosed and runs in oil. The method of suspension and operating the dynamo is very similar to the ordinary scheme used to connect the present electric railway motors to the car axle. Attached to the dynamo is a regulating device, consisting of a series solenoid and field rheostat connected in the shunt field of the dynamo. The storage batteries are suspended beneath the body of the car in an accessible box, and are connected to the dynamo through an automatic controlling switch located in the porter's compartment at one end of the car. This switch consists of a centrally pivoted electro-magnetic bar, the windings on which are connected across the dynamo terminals. Opposite each polar

end of this bar is a stationary magnet connected in series with the circuit from the dynamo. The regulating solenoid previously mentioned is also connected in series with this circuit. Assuming that the batteries have been partly charged and the car is at a standstill, the electro-magnetic switch will be in contact with the storage battery contact terminals and the lamps will be supplied with current from the batteries. As the car moves the dynamo gradually generates current, the lever magnet is being energized, and when the voltage generated has reached a certain point, which is usually set to correspond with a train speed of about twenty miles an hour, the switch automatically throws over, so that the dynamo is connected to the batteries, and the lamps supplied from both sources. As long as the load remains constant the automatic regulating device on the dynamo keeps the current constant. When, however, the number of lights is decreased, the charging current is automatically decreased as well. This is an important feature, as otherwise the batteries could be very easily overcharged if the maximum charging rate were continued with a decreased discharging rate. This is accomplished by means of a small electro-magnetic device operating in conjunction with the regulating solenoid.

The dynamo is provided with a double rocker arm, each fitted with a separate set of brushes arranged to be applied to the commutator at two different diameters of commutation, so that a current in either direction can be taken from the armature. The brushes are set for opposite rotation, one set only being in contact with the commutator. The operation of this double brush holder arrangement is controlled by means of a mechanical device which applies one set of brushes when the axle is turning in one direction, and the other when operating in the reverse direction. The complete system is, therefore, equally operative whether the car moves in either direction. The lights were divided into three circuits, each controlled by a separate switch.

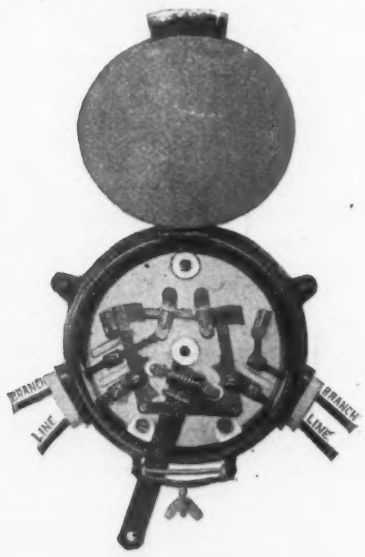
During the demonstration the lights were turned on and off at will without any noticeable effect. Stopping and starting the car and movement in either direction did not seem to affect the constancy and brilliancy of the light in any way. It is to be noted that this system, as at present developed, is the result of a long series of experiments on the same car, covering nearly one and one-half years. The former applications were more or less experimental and showed several deficient features, which have apparently been entirely removed.

Incombustible Ceiling Board and Arc Cut-Out.

The practice of utilizing wood in the construction of ceiling boards for arc lamps and arc cut-outs is rapidly becoming obsolete, and properly so, in view of the latent danger existing in wood when used in any manner in the construction of apparatus used in connection with large electrical currents.

The General Electric Company, Schenectady, N. Y., has recognized the wisdom of using non-combustible material in such devices, and in accordance therewith has produced a ceiling board and an arc cut-out

CEILING BOARD.



ARC CUT-OUT.

which possess primarily the desirable feature of incombustibility. The bases are made of best quality of glazed porcelain, and cast brass is used for connection parts. The lamp is suspended from a hook in the ceiling board, and the lamp leads are attached to easily accessible connectors in the manner shown.

The arc cut-out is a substantially built, quick-break, double-pole, double-throw switch, making an absolute cut-out on both sides of the lamp circuit. A cam and spring action make it impossible to hold the switch at any intermediate point between "on" and "off," so that the current is never opened on the line.

This cut-out may be used as a ceiling board, in which case a hook for hanging the lamp is attached to its center, or it may be placed in an iron box, the hook being removed, for use out of doors. Letters cast on the box cover indicate the "on" and "off" positions of the switch.

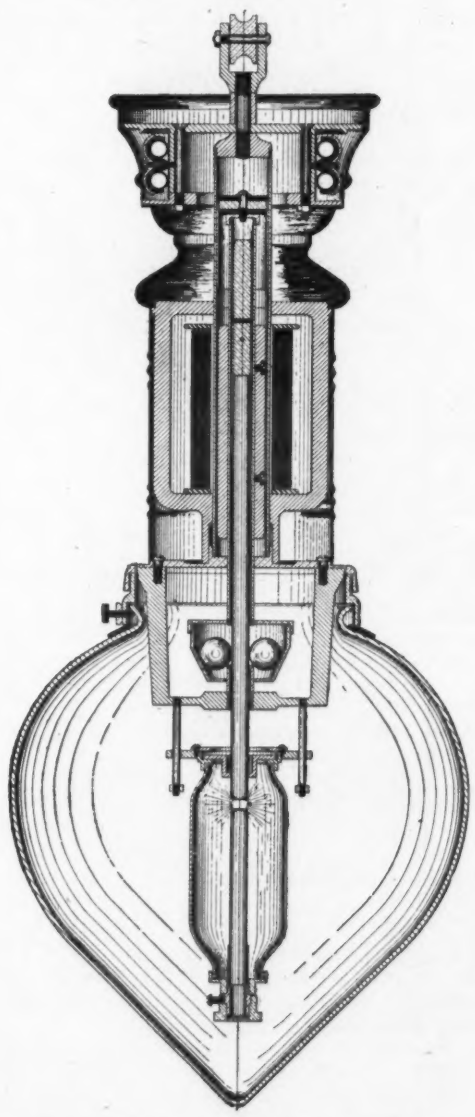
Long-Burning Enclosed Arc Lamp.

The great popularity of long-burning arc lamps has led manufacturers to exercise the greatest ingenuity in the design and construction of lamps of this class.

The lamp illustrated herewith in cross-section is made by the Nowotny Electric Company, Cincinnati, Ohio, and is designed to burn from 125 to 150 hours with one feeding. It is stated to be economical in consumption of energy and maintenance, and gives a soft, steady white light.

The lamps are designed for constant-potential, 100 to 125 volts continuous-current circuits, one lamp being connected directly across the lines. For 220-volt service, two lamps are connected in series across the lines.

From the illustration the internal construction of the lamp will be readily understood. The arc is entirely enclosed by the inner globe and the carbon is gripped directly, without the intervention of any carbon rod. The clutch is composed of four porcelain balls or marbles held in position by a retaining receptacle and performing all the functions of a ball-bearing, arc-maintaining device. The carbon cannot slip except at the proper time, when feeding takes place. In the construction of this lamp, there are neither rods, chimney, clockwork, gear wheels, springs, side rods or outer globe stand to cast shadows.



SECTION VIEW OF ENCLOSED ARC LAMP.

The lamp is easily recarboned, and is made for both interior and exterior service, the outdoor lamp being fully weatherproof and preventing any moisture from getting into the mechanism. These lamps are furnished to consume 4, 4 1-2 and 5 amperes at 80 volts across the arc with 110 volts on the line The extreme length of the inside lamp over all, including the globe, is 30 inches, and the weatherproof lamp measures 33 inches. For interior service these lamps are finished in brass, oxidized copper, barbar or ebony.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, May 10, 1897.

ELECTRICAL STOCKS were more active last week than during the previous week; the changes in quotations were, however, fractional. Edison Illuminating of New York closed ¾ of a point higher than the last previous quotation; Electric Storage Battery regained a fraction of the loss of the previous week, and General Electric remained about steady. The sales of General Electric for the week were 1427 shares.

TELEGRAPH AND TELEPHONE.—This list does not show any marked fluctuations in prices, the range being perhaps narrower than usual. Bell Telephone at the close was one point lower than the last quotation. This stock jumped to 229—an advance of 7 points—on Monday, presumably on the strength of the decision of the Supreme Court in the Berliner case.

	Par.	Bid.	Asked.
ELECTRICAL STOCKS.			
Chicago Edison Company	100	110	..
Edison Electric Ill., New York	100	108	109
Edison Electric Ill., Brooklyn	100	..	97
Edison Electric Ill., Boston	100	..	..
Edison Electric Ill., Philadelphia	100	..	..
Edison Ore Milling	100	7½	10
Electric Storage Co., Philadelphia	100	17½	18
Electric Storage, pref.	100	18½	19½
General Electric	100	31⅛	31⅜
General Electric, pref.	100	70	75
Westinghouse Consolidated, com	50	.	23
Westinghouse Consolidated, pref.	50	49½	50¼
BONDS.			
Edison Electric Ill., New York, con. 5s	105	112	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	96	.
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	222	224
American District Telegraph	100	29	39
American Telegraph and Cable	100	87	89
Central and South American Telegraph	100	124	127
Commercial Cables	100	160	..
Erie Telephone	100	63	64
New England Telephone	100	101½	102
Postal Telegraph Cable	100	96	98
Western Union Telegraph	100	75⅞	76¼
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	19¼	19½
Brooklyn Rapid Transit	..	20	21
Brooklyn Traction	100	..	14
Brooklyn Traction pref	100	46	48
Buffalo Street Railway	100	70	72
Cleveland Electric Railway	100	..	.
Columbus Street Railway	100	43	45
Hestonville	100	49	50
Hestonville, pref.	..	..	62½
New Orleans Traction	100	6	8
New Orleans Traction, pref.	100	27	30
North Shore Traction	100	20	22
North Shore Traction, pref.	100	76	78
Rochester Street Railway	..	12	14
Steinway Railway	..	45	50
Union Railway (Huckleberry)	..	95	103
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	74½	75
West End, Boston, pref.	100	91¼	92
Worcester Traction	100	15	18
Worcester Traction, pref.	100	90	93
BONDS.			
Brooklyn Rapid Transit 5s, 1945	100	79½	..
Buffalo Street Railway 1st con. 5s	100	*106½	108½
Cleveland Electric Railway 1st mtge., 5s	100	103	105
*Columbus Street Railway 1st 5s	100	94	96
Rochester Street Railway 1st 5s	100	..	100
Union Railway (Huckleberry) 1st mtge. 5s	..	101½	107
*Westchester Electric 1st mtge. 5s	100	100	103

*With accrued interest.

ELECTRIC TRACTION STOCKS were quiet throughout the week, the most important changes in quotations being a loss of 2 points in Buffalo Street Railway, and an advance of 2 points in New Orleans Traction preferred. The other changes were fractional and unimportant.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, May 12, 1897.

RUMORS that the incandescent lamp combination has been dissolved have been circulated during the week. No verification of these rumors can, however, be obtained.

MR. H. D. STANLEY, well known in the electric trade through his long connection with the wire manufacturing interests, has become connected with the National Conduit & Cable Company, New York. He will have charge of the cable business of that company.

JAPANESE FAVOR AMERICAN ELECTRICAL APPARATUS.—A local Japanese export firm has received cable advices that two merchants of Tokio are now on their way to this city, where, it is stated, they will contract for electrical and other machinery and hardware specialties. Heretofore they have made their purchases in Europe.

TELEPHONE OFFICERS ELECTED.—At a meeting of the Board of Directors of the New York Telephone Company, held on May 6, the following officers were elected for the ensuing year: Charles F. Cutler, president; Joseph P. Davis, first vice-president; Edward J. Hall, second vice-president; John H. Cahill, secretary; William R. Driver, treasurer.

MESSRS. O. T. CROSBY and C. A. Lieb have leased the plant of the New York Heat, Light & Power Company, at 33-37 Gold Street. Mr. Edward E. Winters has been appointed general superintendent, and under his supervision the plant will be enlarged and extended in many directions. Mr. Winters's ample experience gives promise of future excellent results.

MR. H. BARRINGER COX will describe before the New York Electrical Society at its annual meeting, which will take place at Columbia University, on Thursday, May 20, the development of thermo-electric generators. Practical demonstrations will predominate, and some very interesting information is to be expected from Mr. Cox, who is the inventor of the Cox thermo-electric generator.

MR. CYRUS ROBINSON, general manager of the Ridgway Dynamo & Engine Company, Ridgway, Pa., was in New York during the week on business. Mr. Robinson has made several improvements in the Thompson-Ryan dynamo since he has had charge of the works, and the machine now gives even better satisfaction than formerly. The business of the company has been so good as to tax its facilities to the utmost.

THE AFFAIRS OF THE E. S. GREELEY & CO.—With reference to the published reports that irregularities had been discovered by the receivers of The E. S. Greeley & Co. in the accounts of that firm, General Greeley stated to a representative of THE ELECTRICAL WORLD that he had nothing definite to say on the subject, one way or the other. Only an examination of the books can determine the matter, and as it will require some weeks to do this he was not in a position to state that there had or had not been any defalcation, as alleged.

THE ELECTRIC LIGHT CONVENTION AT NIAGARA FALLS.—Secretary Porter, of the National Electric Light Association, states for the benefit of those desiring to make an exhibit during the convention of the Association at Niagara Falls, June 8, 9 and 10 next that no exhibition will be held under the auspices of the Association, but judging from the tenor of correspondence and personal interviews it is evident that many exhibitions will be made by the associate members (supply dealers and manufacturers) in the parlors and rooms of the hotel.

DINNER OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The annual business meeting and election of the American Institute of Electrical Engineers will be held at the Institute rooms, 12 West Thirty-first Street, on Tuesday, May 18. In addition to the routine business of the meeting a paper will be presented by Dr. Alexander Macfarlane, and the paper on "The Synchronograph," presented at the meeting of April 21, will be taken up for discussion. It is proposed to hold a dinner after the meeting, to which guests may be invited. The meeting will be called at 4 p. m. and adjourned for dinner at 7 o'clock.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., May 11, 1897.

MARRIED.—Mr. Reinold Berrenberg, manager of the Globe Electric Light Company, Malden, Mass., was united in marriage, April 28, to Miss Josephine Berghaus, of Boston. Our hearty congratulations and best wishes are extended.

A LARGE ELEVATOR INSTALLATION.—Messrs. L. A. Chase & Co., Boston, have accepted the New England agency for the well-known Smith-Hill direct-connected electric elevators, and although the agency has only recently been given to it, an important contract has already been made for the installation of ten elevators, passenger and freight, to be placed in one of the large real estate blocks in process of construction in Boston. This is certainly strong evidence of the "hustling" qualities of L. A. Chase & Co.

"THE MUNICIPAL OWNERSHIP OF STREET RAILWAYS" was the topic of discussion at the dinner given by the Massachusetts Reform Club, at Young's Hotel, Boston, on Friday evening, May 7. This subject has been agitated by the club for several months. Prof. Edward W. Bemis, who is the head of the Illinois State Bureau of Statistics, spoke in favor of municipal ownership, taking the ground that it was feasible as well as profitable, and would eventually lead to lower fares. Mr. Osborne Howes opposed the resolution, claiming that municipal ownership was liable to lead to corruption in municipal affairs. Attorney-General Clark, of Tasmania, then briefly addressed the club, and stated that in his country all the railroads would pass into the hands of the Government in about twenty-one years. At present the Government owns the telephone and telegraph lines, and is satisfied.

LARGE DEMAND FOR CIRCUIT BREAKERS.—The following recent sales of Elden automatic machine circuit breakers afford excellent testimony of the merits and value of this device: Summerside Electric Light Company and Charlotte Electric Light Company, Prince Edward Island, one each; North Attleboro municipal plant, North Attleboro, Mass., two; Somerville Electric Light Company, Somerville, Mass., two; Portsmouth Gas & Electric Company, Portsmouth, N. H., two; Woodsville Aqueduct Company, Woodsville, N. H., one; Haverhill Electric Light Company, Haverhill, Mass., two; Winona Railway & Light Company, Winona, Minn., one; Cardington Electric Light Company, Cardington, Ohio, one, and Cambridge Electric Light Company, Cambridge, Mass., one. Messrs. L. A. Chase & Co., Boston, selling agents, have made within the past few weeks the following sales: Fitchburg Gas & Electric Company, Fitchburg, Mass, three; Brockton Edison Company, Brockton, Mass., one; J. S. Viles, Montpelier, Vt., two; Waltham Gas Light Company, Waltham, Mass., one; Fall River Electric Light Company, Fall River, Mass., three; Cumberland Electric Light Company, Nashville, Tenn., one; Lowell Electric Light Company, Lowell, Mass, one, and Red Oak Electric Light Company, Red Oak, Iowa, two.

IMPROVING ITS ARC LAMPS.—The Standard Thermometer & Electric Company, Peabody, Mass., has made several important improvements in the Upton Midget inclosed arc lamp for 110 volt-circuits, since it was last described in the columns of THE ELECTRICAL WORLD. The trimming arrangement has been simplified to such an extent that it is impossible for the globe to be broken except with the most careless handling. The lamp is made in two designs, an ornamental style for indoor use, and a plain one for either indoor or outdoor use. Both styles can be run two in series on a 220-volt circuit, or five in series on a 500-volt circuit, by the addition of differential magnets. The company has also perfected its series inclosed lamp for high-tension circuits, which takes from 65 to 80 volts, as desired, and works on a circuit, carrying from 4½ to 7 amperes. Several of these lamps are now in use on the street service in Peabody, and are giving very excellent results. A number of improvements have also been made in the open-arc alternating lamps, and they can now be run without change on alternating circuits of either 7200 or 16,000 alternations. The factory of the company exhibits remarkable activity. It is a four-story structure, and covers a lot 60x75 feet. It is fully equipped with machinery for turning out a very high grade of work. The testing room contains a very complete switchboard, and is provided with suitable power, supplied by dynamos in the basement, for testing any types of arc lamps.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., May 10, 1897.

PERSONAL.—Mr. Charles R. Huntley, manager of the Buffalo General Electric Company, has been appointed one of the Buffalo City Park Commissioners.

THIS ROAD TO BE REPAIRED.—The receiver for the Lake Ontario & Boulevard Railroad Company, of Oswego, N. Y., has been instructed to issue receiver certificates to the amount of $50,000. The money will be used to repair the road.

RIVAL TELEPHONE COMPANY FOR NIAGARA FALLS.—A new automatic telephone system is to be put in at the Falls, and a company has been organized and franchise obtained. It will be a rival to the Bell Telephone Company.

NEW ELECTRIC ROAD TO CHAUTAUQUA.—The Westfield-Chautauqua motor road is now assured, franchises having at last been granted by both the Westfield and Mayville Village Boards. The termini of the road will be Barcelona, on Lake Erie, and Chautauqua.

THE BUFFALO TRACTION COMPANY'S NEW MANAGER.—Mr. George Chambers, formerly Superintendent of Police, has been appointed manager of the Buffalo Traction Company. Mr. Chambers is a prominent citizen of Buffalo, having served the city in various official capacities. He was latterly superintendent of an electric road on Long Island.

NEW YORK STATE NOTES.

ACTIVITY IN TELEPHONE MATTERS.—New telephone companies are cropping up all over the State. The Utica Telephone Company has been incorporated, and contracted with the New York State Telephone Company to place 500 'phones in Utica. The Lake George Telegraph & Telephone Company has also been incorporated to run from Glens Falls through East Lake George to Shelving Rock.

AN IMPORTANT STREET RAILWAY MEASURE.—The street railway bill now before the Governor is an important document in more ways than one. The bill permits street railways to lease property and guarantee bonds of another railway corporation, provided the consent of 85 per cent. of the stockholders be obtained. Another amendment to the railway law is incorporated in this bill. This amendment is one which prohibits one railway from crossing another's tracks, and from using or running on such tracks for a greater distance than 300 feet. The law now permits one railway to run 1000 feet on the tracks of another under certain conditions.

PITTSBURG NOTES.

PITTSBURG, Pa., May 10, 1897.

DEFECTIVE WIRING CONDEMNED.—The wiring in the City Hall and the Market House in Allegheny has been condemned by the Board of Fire Underwriters, and the Superintendent of Public Lighting has been instructed by the Committee on Public Works to proceed immediately with the complete rewiring of both of these buildings.

FRANCHISE GRANTED.—The Town Council of Manor, Pa., on May 6, granted to the Greensburg, Jeannette & Pittsburg Street Railway Company rights of way through the streets of Manor. This will insure the immediate continuation of the road as far as Irwin. The company agreed to a reduction from 10 to 5 cents in the fare from Manor to Jeannette, to pay a portion of the cost of a bridge, and to repair the streets along its line. It is the intention ultimately to extend this road to connect with the Second Avenue Company's tracks at Wilmerding, which will make a continuous road from Greensburg to Pittsburg.

PHILADELPHIA VISITORS IN PITTSBURG.—On May 4 a large delegation of electrical men from Philadelphia spent the day in Pittsburg examining appliances, machinery and plants. The party was received by some of the officials of the Allegheny County Light Company, and was escorted to East Pittsburg, where the morning was devoted to an inspection of the fine works of the Westinghouse Electric & Manufacturing Company. In the afternoon various power houses and mechanical establishments were visited, and the entire party returned to Philadelphia in the evening. In the party were Mr. Henry Clay, president of the Northern Electric Light Company, and Mr. A. J. DeCamp, manager of the Brush Electric Light Company; also, Messrs. A. J. Holmes, S. Bilyeu, F. Sigg, of the Northern Electric Light Company; Mr. J. H. Vail, of the Pennsylvania Heat, Light & Power Company, and Mr. C. G. Rainer, electrical engineer.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., May 10, 1897.

COL. WICK IN CHICAGO.—Col. S. J. Wick, of the Electric Railway Equipment Company, Cincinnati, Ohio, was a visitor in Chicago last week.

AFTER WESTERN BUSINESS.—The Connecticut Telephone & Electric Company, Meriden, Conn., has opened an office at 193-197 La Salle Street, Chicago, and placed Mr. F. F. Sapp in charge as manager. The company will exert itself in an endeavor to secure a good share of the Western business.

MR. C. H. WILMERDING has resigned his position as general superintendent of the Chicago Edison Company, and will open an office in Chicago as designing, constructing, supervising and consulting engineer, particularly with reference to the planing, remodelling and installing of electric light and power plants.

ST. LOUIS NOTES.

ST. LOUIS, MO., May 3, 1897.

WANTS TO BRANCH OUT.—The Board of Public Improvements has sent to the Assembly a bill giving permission to the Kinloch Telephone Company to lay conduits outside of the regular underground district.

EXTENSION OF TRACKS.—Work has been commenced on an extension of the electric railway tracks which were about two years ago laid on the old Bonhomme road. The Lindell Railway Company has bought the franchise.

RAILWAYS UNITE.—The St. Louis & Suburban Railway has lifted the bonded indebtedness of the St. Louis & Kirkwood electric line, amounting to $300,000, by redeeming the bonds. This means the consolidation of the two roads.

THE BERLINER DECISION.—Judge H. S. Priest, a leading attorney here, says that the decision in the Berliner case will have no effect at all, as it does not determine the validity of the Berliner patents, and that point still remains to be settled. It will in no way interfere with the plans of the Kinloch Company. That company will not use a transmitter that will in any way infringe the Berliner patent. The decision Judge Priest states was based upon the mechanical points involved rather than upon the legal status of the Berliner patent.

NEW SWITCHBOARD DROP.—Mr. Lewis, of the Missouri Telephone Manufacturing Company, St. Louis, has recently perfected a new switchboard drop, for which a patent has been applied. The drop is built on the dynamo principle, and is claimed by the company to be more durable and efficient than any drop heretofore placed on the market. It has been put to all manner of practical tests, several switchboards constructed with this drop now being in use, and it has proved a perfect device. It is believed the invention will prove a valuable one to the company.

ST. LOUIS COUNTY LIGHT COMPANIES MAY CONSOLIDATE.—When a few days ago a receiver was appointed for the Olive Branch Electric Light & Power Company, which has been furnishing points in the county with electricity, the attorney for the Suburban Electric Company was appointed receiver, and it is now regarded as a step taken by the Suburban Company to absorb the Olive Branch Company and form a single organization to furnish light and power throughout St. Louis County. Some time ago the Olive Branch people are said to have offered the Suburban people their plant, but the terms were too high. The intention of the Suburban people, if they do take in the Olive Branch Company, is to build a plant at Webster and retain the present plant of the Olive Branch people at Ferguson, and thus have two plants.

Pacific Coast Notes.

San Francisco, Cal., April 22, 1897.

AN ELECTROLYTIC PROCESS TO BE PRACTICALLY APPLIED.—The United States Smelting & Mining Company, East Helena, Mont., will apply an electrolytic process to its reduction system.

AMERICAN ELECTRICAL APPARATUS FOR HAWAII.—The Government Quarantine Station, Honolulu, H. I., has ordered through the Westinghouse Company's San Francisco agents a 15-kw direct-connected generator, a Westinghouse engine, and other apparatus to make a complete lighting installation.

TO LIGHT VINEYARDS BY ELECTRICITY.—The idea of lighting California vineyards from the San Joaquin Electric Company's long-distance circuits is being carried out. Mr. E. D. N. Lehe, of Stockton, has secured the wiring contract for the lighting of the Paragon and La Favorita vineyards, situated about forty-five miles from the main generating station.

THE SAN FRANCISCO MECHANICS INSTITUTE EXPOSITION.—The thirtieth industrial exposition of the Mechanics Institute of San Francisco, Cal., has been announced to open August 17 and close September 18, 1897. The exhibitors will be aided by generous concessions and a liberal management to present their exhibits in an attractive form. Power for machinery, space, water and light will be free to exhibitors, and large premiums will be paid to the best exhibits in each class. The Mechanics Pavilion, in which the fair will be held, is a building having a floor area of 3½ acres, easily accessible by all car lines, and admirably adapted for this purpose. The secretary, Mr. E. P. Heald, 31 Post Street, San Francisco, is prepared to supply intending exhibitors with all necessary information.

ELECTRIC LIGHT COMPANIES IN SAN FRANCISCO.—Several light and power companies have been incorporated of late in San Francisco, with comparatively small capital. Various reports have appeared in newspapers concerning a prospective electric company that was considering the purchase of an extensive site on the water front at North Beach. On the strength of this some of the daily papers have published "bear" articles regarding the San Francisco Gas & Electric Company, which is a consolidation of the business carried on by the Edison Light & Power Company and that of the San Francisco Gas Company. But the reported opposition has not made public any plans of great extent, and the only formidable competitor of the consolidation is the Mutual Electric Light Company, which has had a rapid growth during its two years of existence.

Canadian Notes.

Ottawa, Ont., May 8, 1897.

SUCCESSFUL FLOATING OF STOCK.—Advices from London, England, state that the issue of $250,000 of the Montreal Royal Electric Company's shares was a distinct success, there being more offers than were applied for in the circular. The issue price was 140.

IMPORTANT WATER POWER DEVELOPMENT.—A company has been formed to take water from the new Welland Canal at Allanburgh and from the Chippewa River at Port Robinson and turn it into Lake Ontario via De Cew's Falls, utilizing the water, where it drops over the mountain's edge, to generate electricity, which will be conveyed by wire to the city of Hamilton to pump water from Lake Ontario into the city, to run the electric street and suburban railways, to move machinery in the factory, to light the streets, and for heating or other purposes. It is expected that 5,000 horse-power will be available four months hence, and 50,000 to 60,000 horse-power at a later date. It is proposed to put in screw pumps at the beach, to be operated by electricity, which will send water through 30 or 36 inch main direct to the city in any required quantity or pressure, the cost to the city being considerably less than the amount now annually expended for fuel and attendance. The whole city is interested in getting the electrical power there as soon as possible.

AN ELECTRIC RAILWAY 285 MILES LONG.—Canada may soon have the distinction of holding the record in electric railway construction. The Huron & Ontario Railway Company was incorporated under a Dominion Act of Parliament to construct and operate a line of electric railway from Port Perry westward to Lake Huron. The length of the proposed road will be about 285 miles. The first water power available is about sixty miles from Port Perry, situated at Thompsonville, in the first section of the road, and would give about 400 horse-power. In the third section there is a water power on the Saugeen River, two miles west of Durham, which would supply 500 horse-power. In the other sections power can be obtained on the Maitland River, near Goderich, where there is a good site capable of developing 800 horse-power. The rolling stock required for each division will be two motor cars and four trailers for passengers, mail and express, and one heavy freight motor, which would give twelve motor cars, twenty-four trailers and six freight motors for the whole line. The total estimated cost is between $4,000,000 and $5,000,000. The original intention was to complete the road early in 1898.

English Notes.

(From Our Own Correspondent.)

London, April 28, 1897.

ELECTROLYTIC ALKALI.—In the report recently presented to the shareholders of the Kastner-Kellner Alkali Company are two interesting items of information. Firstly, it has been discovered that the Cheshire salt will not be fit for use for electrolytic purposes without a preliminary and extensive purifying treatment, and secondly, it is announced that the second half of the plant now nearing completion will be used for the production, not of caustic soda, but of caustic potash.

"DIATRINE" CABLES.—The "Diatrine" cables which Messrs. Glover & Co. have been quietly putting on the market for some time past are at last beginning to attract attention. "Diatrine" is a compound originated by Herr Dia, an Austrian chemist and engineer, who is now superintending its manufacture at the works of Messrs. Glover & Co. It is a non-fibrous compound, containing neither rubber nor bitumen. It is not so elastic as vulcanized india rubber or gutta percha, and it is inferior in mechanical strength, being slightly plastic. It is said, however, to be absolutely waterproof, and while its specific resistance is slightly less than that of vulcanized rubber, its specific conducting capacity is considerably more. It is also said to resist high electrical pressures very well without sparking through. It bids fair to run the impregnated paper insulation of Mr. Ferranti somewhat close in public favor.

ELECTRIC TRACTION.—The concluding meetings of the summer session of the Institution of Electrical Engineers seem likely to be completely occupied with papers dealing directly or indirectly with electric traction. Just before Easter Mr. A. K. Baylor, of the British Thomson-Houston Company, read a paper "On Some Recent Developments in Electric Traction Appliances." This paper, which was of an interesting character, was mainly occupied with the description of an ingenious electromagnetic brake devised by the author. It would seem to possess every virtue except that of having been tried in practice. The author laid great stress upon the fact that the stringency of the Board of Trade rules with regard to earth leakage and fall of voltage would render English practice something very different to that which obtained in the United States. As he pointed out on an extended system in England it is the conductivity of the earth circuit that governs the design of the entire plant. He also severely criticised the 3-wire system of traction, no doubt having his eye upon the proposal of Prof. A. B. W. Kennedy to adopt this method on one of the new London electric tunnel railways. The commencement of the paper was occupied with a disquisition on generators, the text being to support direct coupling. This portion of the paper naturally sounded somewhat superfluous to an English audience, seeing that in this respect England has led the world. Nevertheless the author's remarks under this head scarcely called for the ungenerous sarcasms of several speakers, which sarcasms brought Mr. Preece to his feet and induced him to hold forth for the space of twenty minutes at considerable vigor upon the welcome which should be accorded by all right-minded English engineers to good mechanical and electrical ideas whencesoever they came, remarks which were heartily applauded by the audience. The discussion throughout was of an animated character, and there was a vigorous duel between an English engineer who advocated the 3-wire system for the equipment of the Central London Railway, now nearing completion (a leading engineer of one of the numerous traction companies who have tendered for the equipment of this line), and Mr. H. F. Parshall, who referred to the speaker's remarks as based upon "pure theory" and in flagrant contradiction to American experience. The fact is that there is an extremely keen competition going on over the equipment of the Central London Railway, and this keenness is naturally not lessened owing to the fact that big English mechanical and electrical engineering firms like the Thames Iron Works Company, Messrs. Siemens Brothers, Messrs. Glover & Co., the Electric Construction Corporation, Messrs. Thomas Parker, Ltd., etc., who naturally looked upon the equipment of electrical tunnel railways as the appanage of English firms, now find themselves confronted with a solid phalanx of Anglo-American (mostly the latter) firms armed with the vast and varied experience obtained in the United States. At the close of the discussion on Mr. Baylor's paper a brief but bright note was communicated by Mr. J. S. Raworth on "The Generation of Electrical Energy for Tramways." Mr. Raworth pointed out that in the early days the first problem was to drive the dynamo, the second to drive at an even speed, the third to drive it economically at full load, and the fourth to drive it economically at light load. The burden of the paper was that all these four problems had now been solved, and that instead of central station engineers being somewhat nervous in contracting for the supply of a large number of units at the rate of 3d., they would be making a profit if they were to do so at the rate of 1d. Mr. Raworth pointed out that electric traction work was likely to require a totally different arrangement of plant, and in his opinion we should see in traction stations large direct-coupled engines instead of the extreme sub-division of plant so common in English electric lighting stations. As the average traction load remains fairly steady throughout the day, and the momentary variations are as erratic as they are great, Mr. Raworth thinks no advantage could be gained by the sub-division of plant, and the problem approaches that of factory or mill driving.

General News.

NEW INCORPORATIONS.

THE BAD AXE ELECTRIC LIGHT & POWER COMPANY has been incorporated at Bad Axe, Mich., with a capital stock of $10,000.

THE VIOLA ELECTRIC LIGHT & POWER COMPANY, Viola, Wis., has been organized for the purpose of furnishing electric light and power for the village of Viola.

THE ECONOMIC LIGHT & HEAT COMPANY, Manitowoc, Wis., has been organized with a capital stock of $2,000. The incorporators are G. C. Sedgwick and Herbert L. Larson.

THE ONTARIO TELEPHONE COMPANY, Oswego, N. Y., has been formed with a capital stock of $20,000. The directors are Charles H. Bond, Swits Conde, Robert G. Post, and others.

THE DODGE CITY WATER & LIGHT COMPANY, Dodge City, Kan., has been formed by George M. Myers, John Moore, George S. Gilbert and John P. Loomas. Capital stock, $50,000.

THE WAVERLY TELEPHONE & TELEGRAPH COMPANY, Columbia, S. C., has been organized with a capital stock of $1000. Those interested are L. C. Lachicotte, F. W. Lachicotte, St. J. M. Lachicotte and Louis Bresslauer.

THE MANUFACTURERS' & INVENTORS' ELECTRIC COMPANY OF NEW YORK CITY has been incorporated by Thomas J. Smith, Roselle, N. J.; Edward M. Curtis, and William J. Cordo, Brooklyn, N. Y. Capital stock, $5000.

THE HOME TELEPHONE COMPANY, Fairfield, Iowa, has been incorporated with a capital stock of $3500. The incorporators are J. C. Thorne, Frank Light, E. A. Howard, H. C. Raney, Dr. W. Fordyce, E. F. Simmons and W. R. Hind.

THE CAMBRIDGE TELEPHONE COMPANY, Cambridge, Ohio, has been incorporated with a capital of $10,000. The incorporators are J. A. Weyer, C. S. McMahon, William Hoyle, J. M. Nelson, T. M. McFarland, J. M. Mackey and Jed Williams.

THE WESTFIELD, MAYVILLE & CHAUTAUQUA MOTOR RAILWAY COMPANY, Chautauqua, N. Y., has filed articles of incorporation with the Secretary of State. The purpose of the company is to build a street railway fifteen miles in length, to be operated with any power other than steam locomotives. Capital stock, $150,000.

THE TELEGRAPH AND TELEPHONE.

EDWARDSBURG, MICH.—The residents of this place are considering a proposition to establish a local telephone exchange.

SOUTH BEND, IND.—It is stated that the Elkhart Telephone Company has contracted for a telephone line to Adamsville, Mich., and another to Mishawaka.

DOWAGIAC, MICH.—A telephone line is to be built to Indian Lake, five miles west of here, by several gentlemen who are erecting several cottages at that place.

CASS CITY, MICH.—The Moore telephone exchange in this city has been completed. The company's lines will be run in various directions, and will include Germania, Reese, Millington and Vassar.

CARTHAGE, MO.—Mr. George P. Armstrong, of Peirce City, is endeavoring to secure the support of the Commercial Club here for a telephone line between Carthage and towns in Lawrence and Barry Counties.

SHELBYVILLE, KY.—The Ohio Valley Telephone Company has secured the right of way over the road of the Shelbyville & Mt. Eden Turnpike Company, and it is proposed to build a line to connect these two places.

CROSWELL, MICH.—The Michigan Telephone Company is endeavoring to secure the necessary privileges and rights to establish a telephone exchange here. If arrangements are perfected, the lines will probably be extended throughout "The Thumb."

BAY CITY, MICH.—It is stated that the City Council proposes to take steps having in view the amendment of the city charter to enable the city to go into the telephone business. A committee will, it is stated, endeavor to secure like action in Saginaw and West Bay City.

KIEL, WIS.—A telephone company has been organized here under the name of the Sheboygan & Manitowoc County Telephone Company. It will at once begin the construction of an extensive telephone line between Elkhart Lake, Rhine and other places, connecting the same with Manitowoc.

DETROIT, MICH.—The Fire Commission of this city has awarded the contract to the Detroit Telephone Company to put in new 'phones at all the engine houses, at $20 each, per annum. This action dispossesses the Bell Company from this service, and it is stated that there is considerable hard feeling as a result.

OSHKOSH, WIS.—The distributing board at the Wisconsin Telephone Company's central office in this city was burned on the morning of April 29. About 500 connections were destroyed, and the loss is estimated at about $1200. The building was slightly damaged. The service was re-established in a few days.

BENTON HARBOR, MICH.—Several business men of this city and of St. Joseph have organized a citizens' telephone company to operate at and between the two places. It is stated that they have secured contracts from the majority of the business houses of both cities, and that they intend to establish their system at an early date.

ELECTRIC LIGHT AND POWER.

ASHLEY, PA.—The Economical Electric Light Company has been granted permission to build an electric light plant in Ashley.

PORT GIBSON, MISS.—The citizens have voted in favor of the proposition to establish an electric light plant and water works.

PHILADELPHIA, PA.—The architect's report favoring a new electric light plant at the City Hall at a cost of $60,000 was adopted.

CHATFIELD, MINN.—A franchise has been granted for twenty years to Hon. Joseph Underleak, for the construction of an electric light plant, to be completed within one year.

TAUNTON, MASS.—An agreement has been reached whereby the city of Taunton becomes the purchaser of the Taunton Electric Light Company's plant for $125,000. The city will take possession very soon.

HAMMONDSPORT, N. Y.—Mr. John C. Maxon is one of the leaders in the enterprise, having for its object the instituting of an electric light and power plant in this city. The plant, it is stated, will be operated by water power.

FERNANDINA, FLA.—An arrangement has been effected by the city for the purchase of the electric light plant and increasing the size and efficiency of the engine and dynamos in the same. The city took possession of the plant on May 1.

CATASAUQUA, PA.—The Catasauqua Gas Company is now controlled and operated by the Catasauqua Electric Light & Power Company. Both companies still retain their individuality, but are managed from the office of the electric light company. Mr. Frank M. Tait, superintendent and engineer of the electric light company, now has charge of both concerns.

SOMERVILLE, N. J.—It is stated that the Somerset Lighting Company has made an arrangement with the Raritan Water Power Company, whereby the electric plant of the former concern is to be removed to Raritan. A new power house is now in course of construction, and when completed, it is stated, it will be one of the best-equipped stations in the State. The Somerset Lighting Company proposes to purchase a new generator. It is thought that the new plant will be in operation by the middle of Summer.

CHICAGO, ILL.—The plant of the Mutual Electric Light & Power Company, at Brainard, south of Englewood, was sold at auction under a decree of foreclosure on May 7. The property was purchased for $118,258, by Mr. Frank H. Decke, who, it is stated, represented the first-mortgage bondholders. The plant was built five years ago, and went into the hands of a receiver two years ago. The concern supplied the territory around Englewood and South Englewood. The future disposition of the property has not yet been determined.

THE ELECTRIC RAILWAY.

AKRON, OHIO.—The Akron, Bedford & Cleveland Electric Railway Company has raised the wages of its employees.

EASTON, PA.—The prospects are now said to be favorable for the building of an electric railway between this city and Bethlehem.

CUMBERLAND HILL, R. I.—The people of Cumberland are agitating the project of building a street railway from Lonsdale to Cumberland Hill.

NEW HAVEN, CONN.—Hildreth & Co., New York, have been awarded the contract to build the Rockville extension of the Hartford, Manchester & Rockville Railway Company's line.

HELLERTOWN, PA.—The ordinance granting the South Bethlehem & Hellertown Trolley Company the right to lay tracks through the borough has been finally passed by the Hellertown Council.

EASTON, MASS.—The selectmen of Easton have given a franchise to the Mansfield & Easton Street Railway Company. The road will run as a connecting link between Brockton and Providence.

WORCESTER, MASS.—A meting was held at which articles of association for the formation of the Warren, Brimfield & Wales Street Railway Company were drawn up, and temporary officers elected.

TAUNTON, MASS.—The Plymouth County Railroad has had its franchise extended two years. The outlook for the road is more promising. The route is from Norwell and Mansfield to Brant Rock.

DOYLESTOWN, PA.—The East Penn Traction Company has executed a contract with Messrs. Boody and Wheeler, of Philadelphia, for the construction of the electric railway between Doylestown and Trenton, a distance of twenty-five miles.

BUCYRUS, OHIO.—The Buckeye Traction Company has filed the necessary bonds with the County Commissioners, binding it to begin the construction of the Bucyrus & Galion Electric Railway by the first of June next, in accordance with the franchise heretofore granted. It is expected that the road will be finished by September 1.

Trade and Industrial Notes.

MACHINE TOOL EQUIPMENT ORDERED.—The Parkersburg Rig & Reel Company, Parkersburg, W. Va., which was organized to manufacture oil-well specialties, has just placed an order with the Davis & Egan Machine Tool Company, Cincinnati, Ohio, for the machine tool equipment of its plant.

AMERICAN ELECTRICAL MACHINERY IN MEXICO.—Among the recent exports of electrical apparatus from this country were one 1½-kw, 120-volt S. S. generator and one 3-kw generator, of the same voltage, to Messrs. E. Escalante e Hijo, Merida, Yucatan, Mexico. These machines were made and shipped by the Triumph Electric Company, Cincinnati, Ohio.

A NEW INDUSTRY FOR HARRISON, N. J.—The Hyatt Roller-Bearing Company has taken possession of its new plant at Harrison, N. J., having moved all of its machinery, tools and stock thereto. The company's principal office is also established there. The plant is near the Pennsylvania Railroad station.

ACTIVE TELEPHONE BUSINESS.—The Missouri Telephone Manufacturing Company, St. Louis, Mo., is doing a very satisfactory business with its telephones and switchboards. Mr. Henry A. Coit, the manager, is making himself felt in the telephone field. This company is supplying apparatus for a number of new exchanges.

BACK WITH HIS OLD COMPANY.—Mr. F. C. Fladd informs us that he has again become associated with the E. W. Bliss Company, Brooklyn, N. Y., and that such presses and tools as have been recently designed by him will be reproduced in still better form and soon placed on the market. Mr. Fladd states that he has no connection whatever with the Watertown, N. Y., company.

ENLARGING THEIR PLANT.—The business of Messrs. Huebel & Manger, Brooklyn, N. Y., has increased to such an extent that the firm has enlarged its plant in order to better meet the additional demands upon its facilities. The firm is bringing out new things every now and then, the latest being a double window spring, which has some features of excellence, and which is in every respect up to the standard of the firm's high-grade work.

DOUBLE SERVICE CARBONS are evidently much appreciated, judging from the success that the Elliptical Carbon Company, Chicago, is meeting in their introduction. The company states that during the year ending May 1 last it equipped 312 stations with its special holders. Mr. W. Pfluger, an arc lamp expert of ten years' experience, is doing missionary work for the company, and is meeting with the success that an earnest and capable missionary should meet with. Mr. Charles E. Gregory is manager of the company.

MR. CHAPIN'S NEW BUSINESS.—Mr. Charles E. Chapin, well known in the electrical trade, has opened an office at 108 Greenwich Street, New York City, where he will carry on a business as manufacturers' agent. Mr. Chapin states that he has arranged for the sale of the well-known Packard lamps and transformers, Burnley's soldering paste and stick, the new Hartford snap switches, and other standard goods. He will continue the manufacture of the Perfection woven wire brushes, which are in extensive use on incandescent dynamos.

COLORING FOR INCANDESCENT LAMPS.—The demand for a satisfactory lamp coloring for incandescent lamp bulbs has not altogether been realized, but the Electric Appliance Company, Chicago, is now placing on the market a coloring to be used in such work that is said to be satisfactory. The new material is known as the "electrical chemical lamp coloring," and it is claimed that lamps are colored in such a way that it is difficult to tell them from the genuine colored glass bulbs. An examination of the work done with this coloring indicates that it is a superior article.

A FUEL SAVER.—The Mason hydraulic damper regulator is a device that is worthy of the careful consideration of those generating their own steam for electric lighting and power work. This device will control equally well one boiler or a battery of boilers. It is sensitive, accurate and reliable, and is adjustable to high or low pressures. We have before us a list of a few of the large concerns using this regulator, and in it we find the names of many well-known establishments throughout the country. The device is highly spoken of by those who have had them installed in their plants. It was described and illustrated in the last issue of THE ELECTRICAL WORLD, and is made by the Mason Regulator Company, Boston, Mass.

BIDS FOR STEAM AND ELECTRICAL MACHINERY.—Sealed proposals will be received at the office of Robert Newton, chairman of the Electric Committee, Benwood, W. Va., until Thursday, May 20, for furnishing all the labor and materials for the construction of two 125-hp boilers, two 150-hp engines, one 60-light (2000-cp) arc generator, one 75-kw alternating current incandescent generator, arc lamps, convertors, pole line, etc., all for the electric light plant of the Benwood & McMechen Electric Light, Heat & Power Company, in accordance with the plans and specifications on file with the Electric Light Committee at Benwood. Copies of the specifications can be seen at the office of the company above named.

ENGINES FOR ELECTRICAL WORK.—Electric light and power station managers are always interested in the work of engine builders. The Ball & Wood Company, New York, has in preparation a new catalogue which will fully illustrate, not only its well-known types of horizontal engines, with all improvements to date, but will also show its verticals in different powers. These engines are more than meeting the expectations of the builders, not only in maintaining their high degree of economy, but in their smoothness of operation. Orders received by this company in the past few days include a 300-hp cross compound engine for the Bennington Water Power & Light Company, and a 250-hp cross compound for the Charlestown Gas Company.

AN ARTISTIC CATALOGUE.—A most complete and artistic catalogue has just been issued by the Murray Iron Works Company, Burlington, Iowa, of the Sioux Corliss engine made by that company. Half-tone illustrations of the company's manufacturing plant show it to be a large and modern one. The description of the various engines is most minute, and the illustrations of the same and the innumerable details are produced in an exceedingly artistic manner. Several tables are given which contain considerable statistical data regarding the Sioux City engines. The standard tubular boilers made by the Murray Iron Works Company are also described and illustrated in the catalogue.

ECONOMY OF FUEL.—That this subject is attracting universal attention is evident from the fact that the Fuel Economizer Company, Matteawan, N. Y., is shipping its economizers to various foreign countries. Among the orders recently received for these devices are the following: Claus Spreckels's new beet sugar refinery, Salinos, Cal.; Edison Electric Illuminating Company, Brooklyn, N. Y.; Edison Electric Company, New Orleans, La.; Hamilton Street Railway Company, Hamilton, Ont.; also two orders from Messrs. Castle & Cook, Honolulu, Hawaiian Islands; Jamestown Asylum for the Insane, Jamestown, S. Dak.; R. Hines, Honolulu, Hawaiian Islands; Yokohama Union Electric Light Company, Yokohama, Japan; Star Palace Laundry, Rochester, N. Y.

PRIMARY BATTERIES TO BE PUSHED.—The Nungesser Electric Battery Company, Cleveland, Ohio, has been recently organized, and with increased capital will hereafter conduct an active business in its special line of primary batteries. The company will produce batteries in various forms, such as dry, closed-circuit batteries and chloride of silver batteries, and it claims many new features in its goods that heretofore have been unattained in primary batteries. Its closed-circuit batteries are said to be of very high efficiency for fan-motor work, gas-engine ignition, and other heavy open or closed circuit service. Its sealed portable chloride of silver batteries are in great demand, both in this country and in England, by the manufacturers of motor wagons and others desiring light weight and small size and where constant potential is essential.

NEW AGENCIES ESTABLISHED.—The Phoenix Automatic Filter Company, Racine, Wis., has made arrangements with several well-known houses in various cities to handle the Tracy patent oil filter, which is manufactured by this company. These filters can now be obtained of the following named concerns: Manning, Maxwell & Moore, New York; Brown Brothers Co., Providence, R. I.; Reuter & Mallory, Baltimore, Md.; National Oil Works & Mill Supply Company, New Orleans, La.; N. O. Nelson Manufacturing Company, St. Louis, Mo.; the Bradford Belting Company, Cincinnati, Ohio; George T. Clarkson Company, Pittsburg, Pa.; Central Electric Company, Chicago, Ill.; Chicago Engineer Supply Company; Hendrie & Bolthoff Manufacturing Company, Denver, Col., and Abner Doble Company, San Francisco, Cal.

MAGNOLIA METAL INTERESTS IN EUROPE.—We are informed by the Magnolia Metal Company, New York, that the firm of Sugden, Pound & Wagner, London, England, former selling agents in Europe for this company, has been dispossessed of the agency by the English courts, and that the foreign business of the company is now under the management of Mr. Charles B. Miller, president of the company. The above-named firm and other parties, it is stated, carried on an alleged fraudulent business of making an anti-friction metal and branding it with the trade-mark of the Magnolia Metal Company, of New York. The English courts perpetually enjoined these parties from continuing the selling of counterfeit goods and deceiving the public. It is stated that parties in this country are perpetrating the same fraud, and that a Western firm is now in the courts over the matter.

FOREIGN BUSINESS IN RAILWAY APPLIANCES.—The reputation of the Ohio Brass Company, Mansfield, Ohio, is extending into foreign countries, and in consequence it is receiving many orders from its agents for its electric railway specialties, the utility and practicability of which are being recognized by foreign engineers. During the past week two large foreign orders for Walker ears have been received, one from Japan and the other from Mexico. The Ohio Brass Company, which is the sole manufacturer of this article, has recently brought out several modified forms of the ear used on straight-line suspension, which are adapted for feeder, strainer and splicing purposes, so that the trolley wire can be equipped with Walker ears throughout. These several new designs will be illustrated in the new supplemental catalogue, which is now being prepared for issue. The company reports that its business so far this year considerably exceeds that for the corresponding period of last year, and that it has on hand many large contracts for future delivery.

Business Notice.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 27, 1897.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

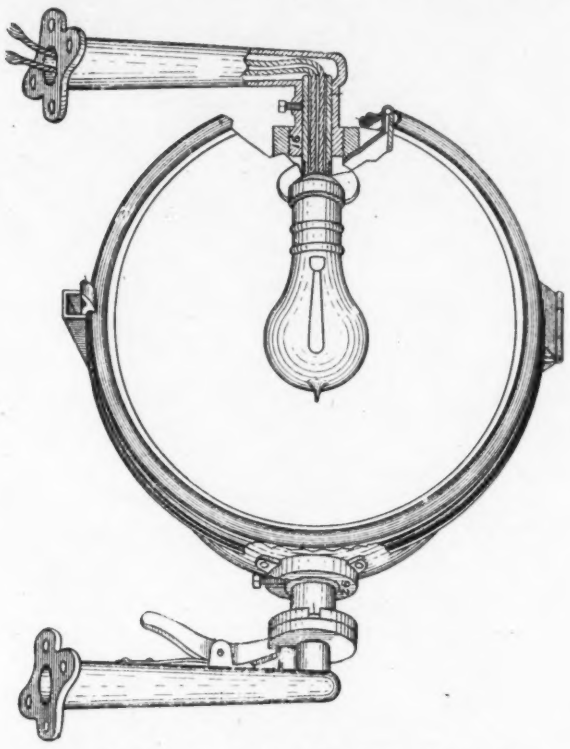
581,456. MOUNTING FOR FUSES; W. W. Dean, St. Louis, Mo. App. filed Sept. 19, 1896. In a mounting for fuse wires, the combination with a fuse terminal, of an ear located thereon to which the fuse wire may be secured, a guide-way being provided in or upon said terminal adapted to receive the fuse wire and to direct it upon said ear, means for securing the fuse wire to said ear, a second fuse terminal and means for securing said fuse wire thereto.

581,460. ELECTRIC FUSE; W. E. Harrington, Philadelphia, Pa. App. filed Oct. 29, 1895. An electric fuse having a central primary section, terminal sections of greater cross-section and masses of non-conducting material arranged to surround portions of each of said terminal sections without inclosing the central primary section.

581,465. REVOLVING ELECTRIC HEADLIGHT; J. Kirby, Jr., Dayton, Ohio. App. filed Feb. 2, 1897. In a revolving headlight, the combination of a screw-threaded bearing at one side thereof and a corresponding screw-threaded journal fixed to a suitable support, and on which said bearing re-

volves, a non-screw-threaded bearing and a corresponding journal on which the same revolves at the opposite side thereof, the latter journal being likewise fixed to a suitable support, and means for controlling the movement of the headlight and securing it in either of several positions on said journals.

581,528. ELECTRICAL ALARM DEVICE; J. J. Barton, Ypsilanti, Mich. App. filed Dec. 12, 1896. In an alarm, the combination of two magnets, a single armature for the magnets, a bell, a knocker for the bell carried by the armature, a normally open circuit, including a battery and one of the magnets, the armature and a contact-point to be engaged by the armature when the magnet is not excited, a normally closed circuit including the



NO. 581,465.—REVOLVING ELECTRIC HEADLIGHT.

other magnet, a battery and two plates and a plug arranged to be inserted between the plates, and when so arranged to cut the magnet out of the said normally-closed circuit.

581,544. THERMOSTATIC FIRE-ALARM; O. A. Enholm and T. H. Beck, New York, N. Y. App. filed Nov. 23, 1896. In an electric thermostatic alarm, the combination with the circuit, of a rotatable recessed disc containing fusible material, and a spring, one end of which rests on the surface of wax, said disc and said spring being connected with the terminals of said circuit.

581,557. CONTROLLER FOR ELECTRIC CARS; S. W. Huff, Baltimore, Md. App. filed July 26, 1895. In a current controller, the combination of two relatively-movable plane parts, a series of terminals to be connected, suitably spaced apart on one of said parts and a corresponding series of bridging contacts carried by the other of said parts, each projecting into a space between two adjacent terminals and pressed against the opposed faces of the same.

581,561. SELECTIVE SIGNAL FOR TELEPHONE CIRCUITS; H. W. Mason, New Bedford, Mass. App. filed July 31, 1896. In a selective signal for telephone circuits, a vertical switchboard provided with a series of inclined parallel ways, having their upper ends provided with switch-points and their upper sides with contact pieces, one of which constitutes one terminal of a bell circuit, a circuit-closer adapted to be switched by said switch-points to traverse either of said contact-pieces, a circuit-closer carrier adapted to be raised vertically over said inclined ways, and when released to resume its normal position by gravity, and means whereby said carrier is raised to any desired point on said switchboard, and released.

581,562. RAIL-BOND; H. S. Newton, Syracuse, N. Y. App. filed Oct. 5, 1896. In a rail-bond cast in one piece, end pieces having large, smooth, inner faces covered with tin or solder arranged in one plane, and a widened, corrugated, connecting-wire arranged in an outer plane parallel to the first plane, so that the whole bond is thin at right angles to the rail.

581,643. AMALGAMATOR; W. Wright, New York, N. Y. App. filed June 12, 1896. In an amalgamator, an amalgamating plate over which the material is adapted to pass, water-distributing tubes arranged to discharge water over the receiving-surface of the plate, the said tubes being provided with carbon outlets, a source of electricity, a circuit leading therefrom and comprising said plate and tubes and mechanism for changing the direction of the current.

581,658. ELECTRIC MOTOR CONTROLLER; W. H. Chapman, Portland, Me. App. filed Feb. 24, 1896. In combination with an electric motor, having a shunt-winding on its field-magnet, an electric switch arranged to make and break the circuit through said field-magnet and to reverse the current in the armature of said motor, a set of resistance coils whose terminals are connected to a series of conducting-segments arranged in the arc of a circle, a contact-shoe arranged to move along the convex peripheral surface of said series of segments, a solenoid connected in series with the said shunt-winding and having its core arranged to operate said contact-shoe and bring it successively into contact with each of said segments, and a cylinder containing a piston and valve arranged to close during the movement of the contact-shoe, but to open during the reverse movement.

581,678. PUZZLE; J. Nesbit, Newark, N. J. App. filed Aug. 4, 1896. A toy puzzle comprising a base-board, intersecting grooves or channels in said board, a ball adapted to roll in said grooves or channels and a pivotally-arranged magnet on said board.

581,684. ELECTRICAL TRANSMISSION OF POWER; R. M. Hunter, Philadelphia, Pa. App. filed Nov. 9, 1887. In a system for the transmission of electrical energy the combination of a primary generator having armature and field magnet coils, a local circuit, a fixed secondary generator having a coil of low resistance in circuit with the primary-generator coils through the local circuit, a line circuit including the other coil of the secondary generator, a tertiary generator located at a distance from the secondary generator and having its fine wire coil in circuit with the line, a distant local circuit including the coarse wire of such tertiary generator, and a translating device in said distant local circuit.

UNITED STATES PATENTS ISSUED MAY 4, 1897.

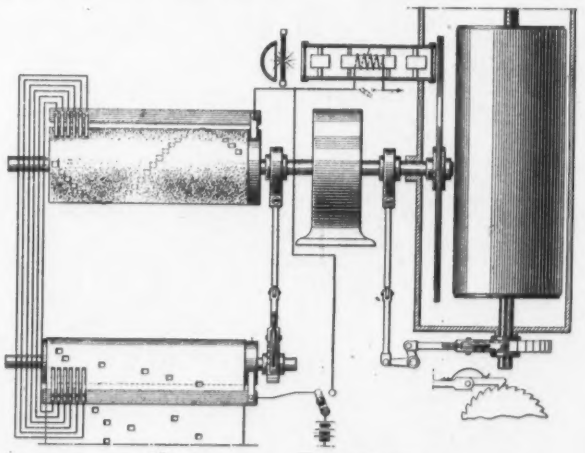
581,706. ELECTRIC SWITCH; G. T. Eyanson, Philadelphia, Pa. App. filed March 21, 1896. In an electric switch the combination of double circuit-terminals, pivoted blades for the respective sets of terminals, an open frame or yoke connecting said blades, an operating-arm extending through said frame or yoke so as to have vertical play therein, and oppositely-acting springs co-acting with said arm and the respective blades.

581,715. ELECTRIC CABLE; M. Guilleaume, Mulheim-on-the-Rhein, Germany. App. filed Oct. 18, 1895. An electric cable, comprising conductors each enclosed within an insulating-envelope, the material of which is, so far as possible, out of contact with and is unsupported by, the conductor, the said envelope being inclosed within a soft "pressing" of rubber or similar material applied in a plastic state and without crushing the envelope upon the conductors.

518,718. ELECTRIC CIGAR LIGHTER; H. M. Handshy, San Antonio, Tex. App. filed Aug. 10, 1896. In an electric cigar-lighter, the combination with the base-casing, tubular standard rising therefrom, separated contact-lugs in the upper portion of said standard, two wires leading from said base-casing through said standard, one wire being connected with one of said contact-lugs and the other wire passing through an opening in said standard and a third wire extending from the remaining contact-lug through an opening in said standard, of a spring actuated bell-crank lever fulcrumed within said standard, a lighting handle supported from said third and second wires, a platinum plate on said lighting-handle, said plate being connected on opposite sides with the ends of said third and second wires, and said last-named wires being connected with the outwardly-extending arm of said lever.

581,769. ELECTRIC RAILWAY; H. C. Reagan, Jr., Philadelphia, Pa. App. filed Dec. 2, 1896. The combination of an electric motor, an air compressor and an air-storage reservoir, pipes leading to and from said reservoir, and having connection with a discharge chamber of the compressor and with the valve-chest of the latter, respectively, an electromagnet suitably supported, and connections common to said motor and magnet.

581,773. RAILWAY; R. C. Sayer, Bristol, England. App. filed April 3, 1896. The means for conveying power from a stationary generator to a car running on rails, consisting of power conveyors on the rail, radial connectors



NO. 581,815.—TELEGRAPHY.

on the wheel adapted as the wheel rotates on the rail to connect with the power-conveyors on the rail, teeth on the rail head and corresponding teeth on the wheel in position laterally and circumferentially.

581,802. AERO-ELECTRIC WHISTLE; Middletown, Conn. App. filed July 13, 1895. A signal consisting of a suitable motor, a worm connected to the shaft thereof, a worm wheel meshing therewith, a lug carried by the worm wheel, a lever operated by the lug and an air-pump having a sounding mechanism adapted to be operated by said lever.

581,815. TELEGRAPHY; C. F. Eaton, Jr., Santa Barbara, Cal. App. filed July 18, 1896. A telegraph apparatus comprising a mechanical pattern of a character or series of characters, located at the sending end, means for moving said pattern, means for presenting the character or series of

characters corresponding to the pattern at a predetermined point at the receiving end, a source of light, a shutter for controlling the admission of light to the said character or series of characters at said predetermined point, an electric circuit, including a commutator and said shutter, and means under the control of said moving pattern for manipulating the said electric circuit to operate the shutter and thereby admit light to the said character or series of characters corresponding to the pattern.

581,873. ELECTRIC TRANSFORMER; E. Thomson, Lynn, Mass. App. filed Jan. 29, 1890. In an iron-clad transformer, the laminated iron envelope having its laminae made each of two sheet-iron punchings fitting together from opposite sides of the coils, and each having a middle limb entering within the coils and the two punchings having arms at each side of the central limb, which meet each other out of coincidence with the middle of the coils, and with successive laminae reversed so that by the unequal length of their limbs they shall break joints.

581,997. ELECTRIC ARC LAMP; M. S. Okun, New York, N. Y. App. filed Aug. 30, 1895. In an arc-lamp, the combination of a sliding carbon-carrying rod and a carbon-carrier at an angle to said rod, the co-operating carbon being held at an angle to the first-mentioned carbon and feeding devices for raising and lowering the carbon rods.

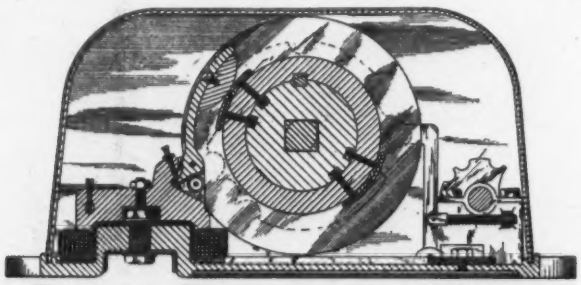
582,036. ELECTRIC FUSE CUT-OUT; W. C. Bryant, Bridgeport, Conn. App. filed March 1, 1897. An electrical fuse cut-out having terminals consisting each of a headed screw and an interiorly-threaded flanged tube, into which the screw fits, the insulating-body having an opening to receive the tube and recessed on its opposite faces, one to receive the flange at one end of the tube and another to form a shoulder over which the other end of the tube is flanged out.

582,077. APPARATUS FOR EXTRACTING PRECIOUS METALS; E. Motz, Brewermine, S.C. Ap p. filed March 27, 1896. In an apparatus for extracting precious metals, the combination of a rotative drum adapted to receive the ore to be treated, a core arranged in the drum metallic plates forming the positive and negative electrodes of an electric circuit and carried respectively on the drum and core, and an electric connection for the plates on the core, the said connection being carried by the drum and arranged to hold the core against turning in the said drum.

582,085. ELECTRIC GAS IGNITER; F. N. Pike, New York, N. Y. App. filed July 8, 1896. In an electric gas-igniter, the combination of a stationary electrode, a movable electrode oscillating about a pivotal point intermediate its ends, an operating lever to which said movable electrode is positively secured, a cam which during the operation of the movable electrode to make contact causes said electrode to oscillate on its pivotal point toward the stationary electrode and then move away therefrom.

582,090. ASTATIC ELECTRICAL MEASURING INSTRUMENT; A. Raps, Berlin, Germany. App. filed Oct. 1, 1896. The combination with an astatic galvanometer or electrodynamometer, of a pair of suitably-shaped cores made of magnetic unmagnetized metal, such as soft iron, placed at a greater distance from the stronger magnet of the astatic system than from the other.

582,093. AUTOMATIC FIRE ALARM; G. B. Riley, Kahoka, Mo. App. filed Aug. 19, 1896. The combination with the base-board having a protecting-hood or cap at the upper end, of contact point or points arranged in the side or sides of said protecting-hood or cap, a contact-plate attached to the lower end of the base-board, said contact-plate having an arm at one end, said arm having an over-lapping portion and forwardly-projecting lips at the end of the contact-plate; binding screw, sensitive circular spring secured between the over-lapping portion of the arm and



No. 582,114.—Controller for Electric Motors.

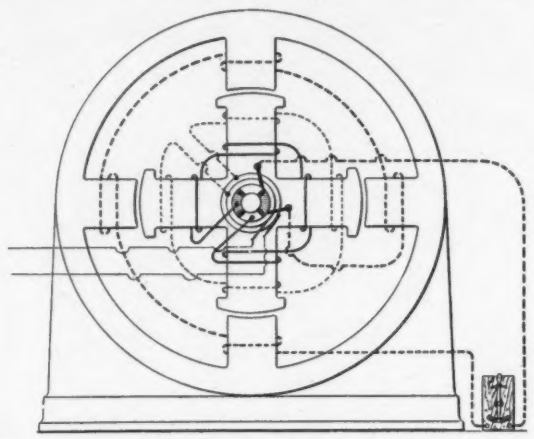
forwardly-projecting lips with the contact-plate, the contact-arm rigidly attached to the free end of the circular spring and angular in cross-section.

582,102. CONTROLLER FOR ELECTRIC CARS; A. Schmid & H. P. Davis, Pittsburg, Pa. App. filed Jan. 17, 1895. In a controller for electric motors, a rotatable contact-bearing cylinder in combination with a shaft for rotating the same, said shaft being detachably connected with said cylinder, and being longitudinally movable when disconnected therefrom.

582,107. SELECTIVE SIGNALING CIRCUIT, APPARATUS AND SYSTEM; G. W. Whittemore, J. A. Barrett, Brooklyn, and W. M. Craft, New York, N. Y. App. filed Nov. 28, 1896. In an electric signaling system comprising a metallic or double-conductor main circuit, extending between a central station and a number of sub-stations; a selective-signal apparatus consisting of a signal receiving device in a local circuit controlled by two relays at each sub-station, the receiving device at each station being selectively responsive through the said relays to a definite and separate or different main-circuit current or current combination, and at the central station, a source of calling current, an earth conductor; and a series of keys representing respectively the said sub-stations and controlling the connection of the two main-circuit conductors, the call current source, and the said earth conductor terminals, each key being organized to establish a different relation of the said terminals and adapted thereby to transmit over one or both of the said main-circuit conductors the particular current or current combination to which the receiving device at the sub-station represented by scuh key, and no other, is responsive.

582,111. SWITCH FOR ELECTRIC CIRCUITS; A. J. Wurts, Pittsburg, Pa. App. filed Nov. 14, 1896. The combination with a supporting-base and a movable blade, of a pair of stationary terminals each of which is provided with a jaw consisting of two inclined bundles of conductors, the free ends of which terminate in planes which are inclined with reference to the co-operating contact-faces of the blade and the maximum distance between which does not exceed the minimum thickness of the contact portions of the blade, whereby said ends are engaged and deflectd successively by the blade in closing the switch.

582,114. CONTROLLER FOR ELECTRIC MOTORS; H. P. Davis, Pittsburg, Pa. App. filed Jan. 14, 1895. The method of controlling the movement of mechanism driven by two electric motors comprising the follow-



No. 582,131.—Alternating Current Regulation and Distribution.

ing steps, connecting said motors in series with resistances, opening the entire circuit, coupling the motors in parallel with resistances and cutting out the resistances.

582,115. METHOD OF AND MEANS FOR CONTROLLING ELECTRIC MOTORS; H. P. Davis, Pittsburg, Pa. App. filed Jan. 14, 1895. The method of controlling mechanism operated by two electric motors, comprising the following steps, connecting the motors in series with resistances, cutting out one of the resistances, shunting one of the motors through the resistance previously cut out, at the same time leaving the other motor and resistance in circuit, cutting out said shunted motor and finally connecting the motors in parallel.

582,120. ASTATIC GALVANOMETER; A. Franke, Berlin, Germany. App. filed Sept. 29, 1896. The combination of a swinging system of astatic needles, and attached thereto a second adjustable magnetic system considerably weaker than the first said system.

582,131. ALTERNATING-CURRENT REGULATION AND DISTRIBUTION; B. G. Lamme, Pittsburg, Pa. App. filed March 27, 1893. The method of harmonizing the phase relation between current and E. M. F. in an alternating-current circuit, which consists in counteracting the existing displacement of phase by adding to the existing waves of current and E. M. F. independent corrective waves which are generated by the inductive action between the armature and field of an electrodynamic-phase controller, and which bear such relation to the existing waves as to establish a substantially harmonizing relation.

582,132. ALTERNATING-CURRENT MOTOR; B. G. Lamme, Pittsburg, Pa. App. filed Oct. 30, 1895. An electric motor comprising an armature having a distributed winding, a starting resistance normally in circuit therewith, a short-circuiting device for said resistance surrounding said winding and means for moving said device into and out of direct engagement with the winding.

582,149. ELECTRICAL SWITCH; J. A. Spiker, Grand Island, Nebraska. App. filed May 14, 1896. A base provided with a curved slot which has a series of notches in one of its edges, a partially revolving rod or shaft extending into the base, an operating handle connected to the shaft, and a sliding plate carried by the handle to engage with the notches in the slot to lock the lever in place, combined with a spring-actuated arm connected to and operated by the sliding plate, and provided at its free end with a contact-plate; radially-disposed contact plates, binding-posts, contact springs corresponding to contact plates and suitable connecting wires.

582,157. TELEGRAPHIC APPARATUS; C. F. Eaton, Jr., New York, N. Y. App. filed Dec. 18, 1896. Telegraphic apparatus, comprising a line circuit, means for sending an alternating current along the line, means for mechanically determining the characters to be transmitted, means for disclosing the characters at the receiving end of the line, a commutator at the sending end of the line arranged to select he characters to be disclosed, a motor for operating the commutator, a pole changer connected with the motor and means under the control of the commutator for operating the said pole-changer by pulsations of one nature and for disclosing the characters by pulsations of an opposite nature.